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EDITORIAL

VETERINARY SURGEONS AND THE LAW

If the members of a community are to live in amity and preserve their rights and privileges it is necessary that they shall conduct their affairs according to an agreed code of rules. These rules can be written down in great detail in the form of a fixed constitution. This method is thought by many to be too rigid, for changes necessitated by the passage of time and altered circumstances are not effected with ease.

In Britain a more flexible method is used. It is based primarily on the great charter granted to his people by King John in the year 1215 A.D. From time to time additions have been made, amendments effected and parts have been discarded according to the circumstances prevailing at particular times. The arbiters of these changes are the members assembled in Parliament and the judges of the High Court. The law of Britain safeguards the rights and privileges of all citizens be they rich or poor, plaintiff or defendant, and the legal code as administered in our land is held in high regard throughout the world. In the eyes of the law all men are equal and through the Legal Aid scheme the poorest man can have recourse to the courts to seek redress for any hurt or damage which he may have suffered. Legal action often occasions great expense and anxiety. Undoubtedly, in the past the former factor has acted as a deterrent to many who might otherwise have sought the help and protection of the courts. This apparent discrimination in favour of those with ample means has now been dispersed, and a beneficient government will provide the ways and means to enable a poor citizen to set the wheels of the law in motion. He can take his troubles to the highest courts in the land even if his assets are nil. It may be this fact which has been responsible for the recent spate of actions in which

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professional men and particularly doctors have been the defendants. There is reason to believe, although the cases have not received similar publicity, that veterinary surgeons have not been exempt from such actions at law. If a man is accused he has the opportunity to submit a defence This may entail considerable personal expense for as a rule a professional man is not classed as being eligible for legal aid. No doubt if a professional man was in need of such assistance most plaintiffs would not proceed to litigation. In the past doctors and veterinary surgeons have been able to carry on their work of healing the sick without thought of legal worry and anxiety for everything that might happen to go wrong. No man is infallible and this is especially so when one is dealing with the multifarious ills that may beset the animal body the most intricate piece of mechanism devised by nature beside which all the wonderous devices of man are as naught. Actions at law which call in question a professional man's skill and competence can bring financial and professional ruin to the unfortunate defendant even if the charge be false. An accusation of negligence, even one which may be proved to be without foundation, receives great publicity when it becomes the subject of court proceedings. It can have an irretrievable and disastrous effect upon a practitioner's professional reputation and livelihood. It may reduce to ruin all those things which result from many years of competent, kindly and diligent service. The anxiety occasioned to the accused and his family cannot be measured by any ordinary standard and the financial implications may be catastrophic. If the defendant succeeds in reputing the charge, the capacity of the plaintiff to pay any part of the legal costs may be nil and this is especially so when the actions brought by a person under the legal aid scheme. The legal aid committee assist a plaintiff but they are not responsible for costs.

In a recent action against a medical man heard before Mr. Justice Hallet at Gloucester Assizes the learned judge made a very pertinent remark, namely, that he made no criticism of the legal aid committee concerned but it was obvious that it was a case of heads I win, tails you lose.

If veterinary surgeons should be confronted with a spate of actions such as has been the lot of medical men in recent times could we blame them if they should do their work with an eye to their own safety or self-preservation. Such a prospect is not in the interests of their patients or clients. Initiative and progress would be stifled.

Professional men can do something to counter this pressing danger. They can combine together for mutual defence In combination there is strength and security. We would urge all practising veterinary surgeons to join a Defence Society. Our remarks have been directed primarily to those occasions when a man is called upon to defend his professional honour and reputation but legal matters impinge in no small measure upon a veterinary surgeon's work. The time is opportune for the formation of a Veterinary Legal Society. Members could be drawn from the legal and veterinary professions. By discussion and debate a store of knowledge could be disclosed which would be of incalculable value.

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GENERAL ARTICLES

THE VALUE OF IODISED MINERAL OIL IN THE TREATMENT OF BOVINE MASTITIS

By W. M. McKAY, Ph.D., M.R.C.V.S.†
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Introduction

ALMOST *the first paper published on the treatment of mastitis was that of Galtier (1901) on the value of "Iodine water."* A year later Radway (1902) using iodine and chinosol injections attempted to treat mastitis but without much success. Motion (1929) reported that Bang *et al* in Denmark used a 1 :2000 aqueous solution of iodine with good results. Pfeiler (1931) used an infusion of cerium iodate, cerium-oxychinolinsulphon and iodine with success. Klein (1932) cured between 75 to 92 per cent of 2,744 cases with tincture of iodine and turpentine, and in some cases with sodium salicylate and boracic acid. Habersang (1933) cured 27 of 29 cases with infusions of "Jodcer" and "Introcid." Lichtenstern (1935) successfully used "Jodosept" infusions.

Binz and Rath (1928) infused "Selectan" C_5H_4 NOI (2-oxy-5-iodo-pyridine) with excellent results. This was used and recommended by many authors. Dahmen (1928) gives the following figures collected from veterinarians throughout Germany. (See Table I).

Dahmen's own figures were: 54 animals treated, 50 cured. Hessler (1928) cured all the eight cases he treated. Staamann (1928) used it in cases of about two months' duration with good results.

TABLE I

	Total number of cows treated with Selectan	Cured	Improved	Not Improved
Recent Cases				
First Group	1,065	797 (74.8%)	123 (11.6%)	145 (13.5%)
Second Group	571	476 (83.4%)	63 (11.0%)	32 (5.6%)
Chronic Cases				
First Group	517	183 (35.4%)	83 (16.0%)	251 (48.6%)
Second Group	179	73 (40.8%)	36 (20.1%)	70 (39.1%)

Yatren, an iodine compound, has been favourably commented on by many writers such as Hennichs (1923) and Mench (1925), while Schlichting (1927), Beschoff (1930) and Gotze (1931) found it disappointing.

Throughout forty-nine years of experimentation, therefore, iodine has played

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a prominent part in the treatment of infections of the udder. Since the introduction of the newer antibiotics, treatment has been along accepted and well tried lines, e.g. sulphonamides, and more recently, penicillin. At about the time attention was focusing on these methods Sanders (1941) published the results of his experiments on the value of iodised mineral oil for this condition, but, because of the prestige of penicillin, Sanders' work seems to have been generally overlooked. Preliminary trials by Sanders indicated that the epithelial tissues of the cow's udder tolerated concentrations of one part iodine crystals ground and dissolved in 1,000 to 1,500 parts of light medicinal mineral oil, but that occasionally individual cows were encountered in which the udder tissues reacted severely to the 1 : 1000 concentration. Sanders therefore suggested a dilution of 1 : 1250. This apparently does no damage to the udder cells. We have also ascertained by *in vitro* tests that the lethal dilution of iodine in mineral oil for *Streptococcus agalactiæ* is 1 : 3800. This concentration rapidly killed these germs.

Material and Method

The iodised mineral oil is prepared in stock solution as follows:

Iodine, resublimed	3.6 grammes
Ether, anæsthetic	45.0 millilitres
Paraffin, light liquid	15.0 millilitres

Dissolve the iodine crystals in the ether in a two ounce bottle. Add the liquid paraffin. Cork tightly and shake vigorously. To prepare a dilution of 1 : 1250, mix the contents of the two ounce bottle in one gallon of light liquid paraffin. This forms a simple, true solution. If the solution is not required immediately, the bottle should be corked tightly to prevent any loss of iodine by volatilisation.

For injecting the oil an ordinary Higginson syringe with a teat syphon attachment works well. Sanders used a special type of pressure injector but the Higginson syringe proved entirely satisfactory in our hands. It is important to use light liquid paraffin.

Technique for Dry Udders

Animals showing pathogenic organisms in the milk, or a high leucocyte content in the milk, due to mild or chronic infection, are best treated during the dry period. After thorough drying off, the milk cistern of the infected quarter is comfortably distended with the iodised mineral oil injected via the teat canal under gentle pressure. Up to 500 millilitres of oil can be injected depending upon the capacity of the milk cistern.

The affected quarter is massaged immediately the injection is completed in order to distribute the solution over the epithelial surface of the mammary tissue. Undue distension of the cistern must be avoided. The iodised mineral oil may be left in the quarter during the whole period the animal is not lactating. It may be of advantage, however, to strip out thoroughly the affected quarter ten to fifteen days after the injection, which is then repeated. This procedure is

particularly important if after ten or fifteen days a thin watery exudate is obtained on trial milking of the affected quarter, instead of a thick creamy oil.

Technique for Lactating Udders

The best results are obtained in non-lactating cows. If, however, it is desired to treat infections in lactating animals—often very necessary—the procedure is as follows. The diseased quarters are stripped as thoroughly as possible, rinsed once or twice with the iodised mineral oil until the gross debris is removed, and are then injected with up to 500 millilitres of the preparation as described above. Two or three treatments may be given at 24-hour intervals. Regular milking of these infected quarters is recommended until they can be dried off, when they are again injected with the iodised mineral oil as in the case of dry udders.

In acute mastitis, oil may be injected without causing additional irritation of the inflamed glandular tissues. The affected quarter is injected with 300 to 500 millilitres of iodised oil, thoroughly massaged and then stripped. This may assist materially in the removal of grossly infected coagulum, an important consideration in treating acute cases. Below in Table II are the results of nine cases of mastitis treated by Sanders with iodised oil.

Bacteriological Examination

In order to test out Sanders' claims, cases of mastitis which had failed to respond to the recognised methods of treatment were selected for trial. Quarter samples of fore-milk from the allegedly refractory cases were taken in one

TABLE II

Sanders' results of nine cases of Mastitis treated by intramammary infusion of Iodised Mineral Oil

Quarter affected	No. of months infected	Type of organism cultured	Amount of oil injected (c.c.)	Dilution	Number of treatments	Organisms cultured after treatment	No. of days within which organisms disappear from milk	No. of weekly examinations made after treatment
Left fore	8	HS	300	1 :1500	1	none	2	7
Right rear	3	NHS	200	1 :1000	1	none	1	8
Left fore	4	NHS	100	1 :1000	1	none	2	8
Right rear								
Right fore	12	HS	225	1 :1000	1	none	7	3
Left fore								
Right rear	12	HS	225	1 :1500	1	none	2	3
Left rear	4	MI	200	1 :1500	1	none	1	8
Right rear	4	ST	300	1 :1000	1	none	2	3
Left fore	2	HS	250	1 :1500	1	none	6	4
Right fore	3	NHS	150	1 :900	1	none	2	8

HS = Hæmolytic streptococci; NHS = Non-hæmolytic streptococci; MI = Micrococci; ST = Staphylococci.

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ounce sterile McCartney bottles after the udder and teats were cleansed with Cetavlon and dried.

0.05 ml. of each sample was placed in sterile 4 in. petri dishes to which was added 14 c.c. of blood agar containing 1 :750,000 crystal violet, 1 :3,000 thallium sulphate, and 1 :1,000 aesculin. Plates were incubated for 24 hours at 37° C. and examined. Identification of organisms was made by cultural appearances and biochemical tests. Plating on plain blood agar was carried out in order to recover staphylococci.

Note.—Where sulphanilamide had been used in treatment 0.005 per cent amino-benzoic acid was added to the media.

Post-treatment tests were carried out at approximately 7-10 days following the completion of treatment and repeat tests made at intervals of one month to six weeks.

Results

Results are given of treatment of twenty-two cases of mastitis involving a total of forty-seven quarters. In the majority of cases complete bacteriological and clinical examinations had been carried out before and after treatment. Cases are divided into five groups, dependent on the previous treatment given.

GROUP I

Group I (Table III). This consisted of four cases (seven quarters) previously treated with two and a half to five ounce doses of sulphonamide alone.

TABLE III

Number of cases	Data before treatment with Iodised Mineral Oil		Results following treatment with Iodised Mineral Oil	
	Clinical	Bacteriological	Clinical	Bacteriological
Four being nos. 3, 6, 7 and 10	3 chronic, 1 acute, all with varying degrees of changed secretion	3 streptococci Str.agalactiæ in 5 quarters Str. dysgalactiæ in 1 quarter. 1 case (1 quarter) hæmolytic staphylococci	3 showed complete recovery. 1 hæmolytic staphylococci no marked improvement	2 negative at 2 tests during 4 months post treatment. 1 negative for 11 months. 1 hæmolytic staphylococci assessment difficult, no organisms isolated but leucocyte count remained high

As can be seen from the table, three (six quarters) responded promptly to iodised mineral oil. Where the mastitis was due to hæmolytic staphylococci the appearance of the milk did not return completely to normal, although the infection appeared to have been sterilized.

Group II. This consisted of one case previously treated with penicillin alone *viz.* 50,000 units of penicillin administered three times on six consecutive

days. One month later a single dose of penicillin was given. The udders then remained free from infection for three weeks; after which a streptococcal infection appeared in one treated quarter and hæmolytic staphylococci in the second. These two quarters were infused with iodised mineral oil and examination of post treatment samples taken one week later showed the infection to have been removed. Due to other reasons this animal was sold thus preventing further post treatment tests.

Group III (Table IV). This consisted of twelve cases (thirty-one quarters) previously treated both by penicillin infusion and sulphanilamide.

In two cases, one chronic and the other subacute, blood appeared in the milk for one to four days following injection of iodised mineral oil. This did not in any way affect the marked clinical improvement which finally occurred.

TABLE IV

Number of cases	Data before treatment with Iodised Mineral Oil		Results following treatment with Iodised Mineral Oil	
	Clinical	Bacteriological	Clinical	Bacteriological
Twelve	5 (14 quarters) chronic with clots and altered secretion. 5 (12 quarters) subacute with induration of quarters. 2 (5 quarters) acute	Str. agalactiæ 19 quarters. Str. dysgalactiæ 2 quarters. Hæmolytic Staphylococci 8 quarters. Str. Uberis 2 quarters	In 9 the udder returned to normal with no clinical evidence of disease	All quarters were negative on bacteriological tests during the period in which the animal was under observation. (This varied from 1-8 months). Tests carried out 14 days after treatment and subsequently at monthly intervals following

In this group (III) all quarters were bacteriologically sterilized after injection with iodised mineral oil and these quarters did not become reinfected during the period (one to eight months) in which the animals were being retested. From the clinical aspect, nine cases (twenty-six quarters) returned completely to normal and in those cases in which information was available, a noticeable increase in the milk yield resulted. In the remaining three cases (five quarters) the clinical improvement was good, the appearance of the milk returned to normal.

Group IV. This group consisted of two cases (nos. 11 and 12) previously treated with proflavine alone.

Case 11. Proflavine was infused into all four quarters of this cow following the appearance of clinical symptoms. No bacteriological examination was made at this stage. Three days after the proflavine treatment, bacteriological examination revealed large numbers of *Str. agalactiæ* in all four quarters. Two injections of iodised mineral oil were made into each quarter at an interval of one week. Subsequent bacteriological examination made one week later showed continued

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evidence of *Str. agalactiæ* infection in all four quarters. This infection disappeared, however, without further treatment and the milk was negative when tested one month later.

Case 12. Opinion on this case is difficult to form due to lack of data. The animal showed mastitis in one quarter (no bacteriological examination was made). This quarter was irrigated with proflavine but subsequent bacteriological examination showed evidence of infection with *Str. dysgalactiæ*. Following injection of iodised mineral oil the infection, as judged by bacteriological examinations made two weeks later, appeared to be considerably reduced, and on tests at six weekly intervals up to six months no evidence of infection was observed although a high leucocyte content of the secretion (up to 1,000,000) was noted for three months.

Group V (Table V). This group consisted of three cases which had no previous treatment.

TABLE V

Number of cases	Data before treatment with Iodised Mineral Oil		Results following treatment with Iodised Mineral Oil	
Three	Clinical	Bacteriological	Clinical	Bacteriological
No. 9	Clinical evidence in one quarter	Str. agalactiæ	Quarter now quite normal and milking well	Negative at two tests during three months
No. 13	Quarter very hard and indurated	Str. dysgalactiæ	Quarter gradually returned to normal	Negative at one test 3 months after treatment
No. 14	Quarter slightly indurated	Probably infected with Str. agalactiæ	No data	Negative at one test 3 months after treatment

Discussion

While it is unwise to generalise on a relatively small number of cases, iodised mineral oil appears to be a therapeutic agent of considerable value.

Further large scale tests are necessary in order to draw final conclusions. It is proposed to carry these out, and if they confirm the above findings support will be given to Sanders' claims for the use of iodine in this field.

As indicated from work being carried out in Devon infections of the bovine udder due to *Str. dysgalactiæ* and *Str. uberis* are on the increase and they are proving to be more resistant to penicillin treatment even where this involves the use of 50,000 and 100,000 units of penicillin carried out on four or five consecutive days. Staphylococcal infections are proving very resistant to such treatment. Where a cure seems to have been effected in these staphylococcal cases it has been found that clinical or sub-clinical evidence of infection ensues after several weeks. This may be due to incomplete sterilization or to reinfection. Even in herds where strict hygienic precautions are taken reinfection with staphylococci is liable to occur.

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The unsatisfactory results reported following penicillin treatment would appear to be due to reinfection in many cases and they seem to indicate that insufficient attention is paid to removal of extraneous infection. It has been found that in many of these cases cracks on the teats, often involving the region of the sphincter muscle were present. Iodised mineral oil has been shown to be of some value in treating these injuries and removing infection. Lugol's solution of iodine would appear to be a more active and effective agent in this connection.

Iodised mineral oil has the advantage that it is cheap. One treatment is usually sufficient in cases of Streptococcal infection, and in Staphylococcal infection two or three treatments at intervals of forty-eight hours would appear to be necessary. It is easy to prepare and retains its germicidal properties well.

It has the disadvantage that its oily nature makes it less pleasant to use and the volume required is fairly large. It is hoped that 50 millilitres may prove effective and that it will be possible to supply the preparation in collapsible tubes.

The dose of iodised mineral oil given in all these cases was 100-300 millilitres, depending on the size of the quarter. In only two cases of streptococcal infection was a second treatment necessary.

In some cases of Staphylococcal infection two or three treatments with 100-300 millilitres of iodised mineral oil were required. In two of these cases some irritation of the gland epithelium seemed to occur and further trials would appear to be necessary in order to determine the effect of more prolonged treatment.

In attempts to control *Corynebacterium* infection, dry cows have been injected with the oil when turned out in the summer. Preliminary results indicate that such treatment has some prophylactic value. Extended trials using adequate controls are to be carried out in order to test the effect of iodised mineral oil in preventing this form of infection.

Note.—All cases referred to were treated under ordinary farming conditions, and in general, cases that had proved refractory to the usual methods of treatment with penicillin and other preparations were selected for testing the effect of iodised mineral oil. In many of these resistant or allegedly resistant cases the possibility of ineffective treatment with penicillin, etc., and *subsequent reinfection from outside situations* cannot be ruled out. In the majority of cases, however, frequent but somewhat irregular tests were carried out following these treatments and it was shown that the treatment had not removed the infection. In vitro tests showed that in some cases where *Str. dysgalactiæ* and *Str. uberis* infections were diagnosed strains of these organisms slightly resistant to sulphanilamide were present.

Addendum

The details of a further thirty-three cases with 84 quarters affected are given in tabular form hereunder. The results of treatment of these cases has only become available after the paper had been written. They are given in tabular form for ease of interpretation.

See following Tables on pages 174-181

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Case No.	Qrtr.	PRETREATMENT FINDINGS Clinical	Bacteriological	Treatment Prior to Use of I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological
23	R.H.	Clots and	Str. agalactiæ+++	Penicillin 100,000 4	Apparently	Str. agalactiæ++
	R.F.	A.S. all	Str. agalactiæ++	consecutive days.	effective	Negative
	L.H.	quarters	Str. agalactiæ+	Pr. Penicillin after	for 10-14 days.	Str. agalactiæ+
	L.F.		Str. agalactiæ++	14 days.	Recurred.	Str. agalactiæ+
				Repeat after 10 days.		
24	R.H.	A.S.	Staph. pyogenes++	Penicillin 100,000 4	Unsatisfactory.	Staph. pyogenes++
	R.F.	—	Negative	consecutive days.	A.S.	Staph. pyogenes+
	L.H.	A.S.	Staph. pyogenes++	Pr. Pen. after 10	Reduced yield.	Staph. pyogenes++
	L.F.	—	Negative	days.		Negative
25	R.H.	Reduced	Str. agalactiæ++	Penicillin 100,000, 2	Only temporary	Negative
	R.F.	milk	Str. agalactiæ+++	courses, followed	cure. Recurrence	Str. agalactiæ++
	L.H.	yield	Str. agalactiæ++	by sulphanilamide	at intervals of	Str. agalactiæ+
	L.F.	Clots all	Str. agalactiæ++	5 oz., 2½, 2½, 2½ oz.,	7-21 days.	Str. agalactiæ+
		qtrs.		10 days after final penicillin.		
26	R.H.	—	Negative	Sulphanilamide	Only temp. cure.	Str. dysgalactiæ++
	R.F.	—	Str. dysgalactiæ++	5 oz., 2½, 2½, 2½,	Symptoms re-	Str. dysgalactiæ++
	L.H.	Showed	Str. dysgalactiæ++	about 10 days later	curred at	Str. dysgalactiæ+
	L.F.	swelling of transient nature. Reduced yield.	Str. dysgalactiæ++	penicillin.	intervals.	Str. dysgalactiæ++
27	R.H.	R.F. swol-	Str. uberis+++	Pr. penicillin—	Slight improve-	Str. uberis++
	R.F.	len, and	Str. uberis++	2 courses at inter-	ment, but symp-	Str. uberis+
	L.H.	A.S.	Negative	vals of 3 weeks.	toms reappeared.	Str. uberis+
	L.F.	Reduced yield.	Negative			Negative
28	R.H.	--	Negative	Procaine pen.	No improvement.	Negative
	R.F.	—	Negative	Toxoid.		Negative
	L.H.	Swollen, A.S.	Staph. pyogenes++	Procaine pen.		Staph. pyogenes & dip.
	L.F.	—	Negative			Negative
29	R.H.	—	Negative	Procaine Penicillin	Very slight im-	Negative
	R.F.	—	Negative	200,000 with toxoid	provement.	Diplococci
	L.H.	—	Negative		Swelling reduced.	Negative
	L.F.	A.S. and swollen	Staph. pyogenes++		Secretion still altered.	Staph. pyogenes+
30	R.H.	—	No test made	Penicillin,	Quarter still	No test made
	R.F.	Swollen, pus		Sulphanilamide	swollen, no	
	L.H.	—		Procaine Penicillin	response to	
	L.F.	—			treatment	
31	R.H.	—	Negative	Procaine Penicillin	Slight improve-	R.H. and L.F.—
	R.F.	Swollen	Str. dysgalactiæ+	in both quarters	ment, temporary	negative
	L.H.	Swollen	Str. dysgalactiæ++			R.F. and L.H.—
	L.F.	—	Negative			S.M.A. few
						Str. dysgalactiæ
32	R.H.	—	Negative	Penicillin both	Recurred after	Str. dysgalactiæ
	R.F.	Swollen, A.S.	Str. dysgalactiæ++	quarters	apparent cure	Str. dysgalactiæ
	L.H.	—	Negative			Negative
	L.F.	—	Str. dysgalactiæ+			Negative

Procaine penicillin treatment—100,000 units repeated at 72 hours. Iodised Mineral Oil treatment—the I.M.O. was left in the gland for 12-24 hours as indicated in column. Penicillin treatment—100,000 units on four consecutive days.

Treatment with I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological	Period Tests Carried out	Remarks
50 c.c. each quarter —24 hours. Repeated 2 days—24 hours.	No further symptoms	Negative Negative Negative Negative	3 months at intervals of 1 month	No further evidence of infection. Now milking well. Yield slightly improved.
80 c.c. 24 hours. Repeated in 24 hours.	Milk appeared altered for 2 milkings after treatment, followed by recovery.	Negative Negative Staph.+ 3rd test Negative	9 weeks, intervals of 14 days.	No further signs of infection. Gland and milk apparently normal. Milk yield normal.
50 c.c. left in gland 24 hours.	No further evidence of infection.	Negative Negative Negative Negative	4 months at intervals of 3 weeks.	No further evidence of up to time of cow going dry. Milk yield improved by about half gallon on subsequent lactation.
80 c.c. followed by 50 c.c. after 2 days.	No further symptoms.	Negative on test 10 days after treatment. Str. dysg.+ on 2nd test—3 weeks.	4 months.	Slight evidence of infection appeared on second test, but no further evidence.
50 c.c. only.	Milk altered for 3 milkings after treatment, followed by recovery.	Negative all quarters.	2 months.	No further evidence of infection reported.
100 c.c. repeated 2 days.	Some irritation of glands marked for 2 days. Continued for 2 weeks.	Negative at all quarters.	10 weeks	Gland returned to normal. Now milking normally.
100 c.c. followed by 50 c.c.	Fairly sharp irritation. Blood	Blood in milk. High cell count. No organisms.	1 month	Some atrophy of quarter
800 c.c. (2 treatments of 400 c.c.)	No further evidence	Negative Negative. S.M.A. Negative Str. dysgalactiæ+	2 months	No further signs of infection. R.F. quarter now dry
100 c.c. each quarter	Recovery for 3 weeks. Improvement. Recurrence	Negative Negative Str. dysgalactiæ++ Negative	2 months	Not very successful. ? possibility of reinfection.
80 c.c.	Recovery	Negative Negative Str. dysgalactiæ Negative	2 months	No further evidence of infection

Case No.	Qtr.	PRETREATMENT FINDINGS Clinical	Bacteriological	Treatment Prior to use of I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological
33	R.H.	Reduced	Str. uberis++	Sulphanilamide	Recurred after	No test made
	R.F.	milk yield	Str. uberis+	only	apparent cure	
	L.H.		Str. uberis+++			
	L.F.		Str. uberis+			
34	R.H.	—	No test made	Penicillin	Swelling of	Negative
	R.F.	—		followed by	glands	Negative
	L.H.	A.S.		Procaine Penicillin		Yeasts
	L.F.	A.S.				Yeasts
35	R.H.	A.S.*	Str. dysgalactiæ	Pen. 100,000 units	Only temporary.	Negative
	R.F.	—	Str. dysgalactiæ	on 4 consecutive	Clots appeared	Negative
	L.H.	—	Negative	days. Repeated after	after 10 days.	Str. dysgalactiæ
	L.F.	A.S.	Str. dysgalactiæ	14 days.		Str. dysgalactiæ
36	R.H.	Clots	Str. agalactiæ	No previous	—	—
	R.F.	Clots	Str. agalactiæ	treatment		
	L.H.	Clots	Str. agalactiæ			
	L.F.	Clots	Str. agalactiæ			
37	R.H.	A.S.	Staph. pyogenes	Pen. 100,000 units	No cure	Staph. pyogenes
	R.F.	A.S.	Negative	on 4 consecutive		Negative
	L.H.	Clots	Negative	days. Udalac after		Staph. pyogenes
	L.F.	Clots	Negative	14 days.		Staph. pyogenes
38	R.H.	Clots	Staph. pyogenes	Pen. 100,000 units	Clots at	Micrococci
	R.F.	Clots	Staph. pyogenes	on 4 consecutive	irregular	Staph. pyogenes+
	L.H.	Clots	Staph. pyogenes	days. Procaine	intervals	Staph. pyogenes+
	L.F.	Clots	Staph. pyogenes	Pen. on 4 consecutive days.		Staph. pyogenes+
39	R.H.	A.S. and	Negative	Pen. 100,000 units	Thick clots	Negative
	R.F.	clots all	Staph. pyogenes++	on 4 consecutive		Negative
	L.H.	qtrs.	Negative	days.		Negative
	L.F.		Staph. pyo.+++			Str. dys. and Staph. pyogenes
40	R.H.	S.S.A.	No test made	Pen. 100,000 units	Clots still	Str. uberis and
	R.F.	and clots		on 4 consecutive	present	Staph. pyogenes
	L.H.	all qtrs.		days. Procaine		Negative
	L.F.			Pen. 2 days after one week.		Micrococci Micrococci
41	R.H.	Clots	Negative	No previous	—	—
	R.F.	Clots	Negative	treatment		
	L.H.	Clots	Staph. pyo. & mic.			
	L.F.	Clots	Str. dysgalactiæ			
42	R.H.	A.S.	Staph. pyogenes++	No previous	—	—
	R.F.	A.S.	Staph. pyogenes++	treatment		
	L.H.	—	Negative			
	L.F.	—	Negative			
43	R.H.	Clots	Staph. pyogenes+	No previous	—	—
	R.F.	Clots	Negative	treatment		
	L.H.	Clots	Negative			
	L.F.	Clots	Negative			

* Reduced yield.

Treatment with I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological	Period Tests Carried Out	Remarks
50 c.c.	—	Negative Negative Negative Negative	3 months	No further evidence of infection
80 c.c.	Gradual recovery over two weeks	Negative Negative Negative Negative	2 months	Some atrophy of quarters and induration
No. 197 50 c.c.	No further evidence of clots. Milk yield improved.	Negative Negative Negative Negative	2 months	
No. 197 50 c.c. Repeated 2nd day.	No further evidence	Negative Negative Negative Negative	1 month	
No. 200 80 c.c.	Marked induration. Blood, large clots all quarters.	Negative Negative Negative Negative	2 weeks	Glands still indurated Evidence of cellular disintigration for 2 weeks, gradual recovery but gland still abnormal.
No. 197 50 c.c. Repeated after 3 days.	Clear S.S.A. Clear Clear	Negative Negative Negative Negative	Clear at last test six weeks after completion of treatment.	Complete cure
No. 201 80 c.c. in all quarters.	Clear Few clots Few clots Clear	Negative Negative Negative Staph. pyogenes++	6 weeks	Evidence of irritation in all quarters. Some blood and thick clots. Infection removed except L.F. quarter.
No. 200 80 c.c. Repeated in R.H. after 14 days.	Clots in R.H. qtr. marked. Few clots in other qtrs.	S.M.A. Negative Negative Negative Negative	6 weeks	Marked irritation of quarters. Large clots. Evidence of blood. Gland remained swollen and for 3 weeks gradual recovery. Secretion reduced.
No. 197 80 c.c. in L.H., R.H., and L.F., R.F.	Clots Clots Clots Clots	Negative Negative Negative S.S.A. Negative	Clots L.F.—marked and still present in all other qtrs. No evidence of infection at test after one month.	Whilst there appears to be a cure as revealed bacteriologically. Clots present for about 1 week in L.F.
No. 201—80 c.c. in R.H. and R.F. No. 197—80 c.c. in L.H. and L.F.	A.S. A.S.—blood — —	Staph. pyogenes+ Negative Negative Staph. pyogenes+	3 weeks. Blood and amber-coloured secretion for several days in R.F. & R.H.	
No. 201 80 c.c. all quarters	Clots all quarters	S.M.A. Staph. pyo. S.M.A. Negative S.M.A. Negative S.M.A. Negative	3 weeks. Induration of all quarters. Large clots, some blood	Evidence of cellular induration all quarters. Reduced yield. Marked leucocytosis.

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Case No.	PRETREATMENT FINDINGS Qtr.	Clinical	Bacteriological	Treatment Prior to use of I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological
44	R.H.	Clots	Staph. pyogenes	Penicillin 100,000 on 4 consecutive days all quarters.	No test made	
	R.F.	Clots	Staph. pyogenes			
	L.H.	Clots	Staph. pyogenes			
	L.F.	Clots	Staph. pyogenes			
45	R.H.	Clots	Staph. pyo.+++	No previous treatment	—	—
	R.F.	Clots	Str. dysgalactiæ			
	L.H.	Clots	Evidence of blood			
	L.F.	Clots	Evidence of blood			
46	R.H.	A.S.	Str. dysgalactiæ	No previous treatment	—	—
	R.F.	A.S.	Str. dysgalactiæ			
	L.H.	—	Str. dysgalactiæ			
	L.F.	A.S.	Negative			
47	R.H.	A.S.	Str. uberis+++	No previous treatment	—	—
	R.F.	and clots	Str. uberis+			
	L.H.	all qtrs.	Negative			
	L.F.		Str. uberis+++			
48	R.H.	—	Negative	No previous treatment	—	—
	R.F.	A.S.	Str. dysgalactiæ++			
	L.H.	A.S.	Str. dysgalactiæ+			
	L.F.	A.S.	Str. dysgalactiæ+			
49	R.H.	—	Str. uberis	No previous treatment	—	—
	R.F.	—	Str. uberis			
	L.H.	—	Negative			
	L.F.	—	Str. dysgalactiæ and Str. uberis			
50	R.H.	—	Negative	Penicillin 100,000 on 4 consecutive days. Repeated after 2 days	—	Str. uberis
	R.F.	—	Str. uberis		—	Str. uberis
	L.H.	—	Str. uberis		—	Str. uberis
	L.F.	—	Negative		—	Negative
51	R.H.	A.S.	Staph. pyogenes++	Penicillin 100,000 on 4 consecutive days. Udalac one treatment after 10 days	Clots, A.S. all quarters	No test carried out
	R.F.	A.S.	Staph. pyo.+++			
	L.H.	—	Staph. pyogenes++			
	L.F.	—	Negative			
52	R.H.	—	Str. dysgalactiæ+++	No previous treatment	—	—
	R.F.	—	Negative			
	L.H.	—	Str. dysgalactiæ+++			
	L.F.	—	Negative			
53	R.H.	A.S.	Str. dysgalactiæ+++	No previous treatment	—	—
	R.F.	—	Negative			
	L.H.	—	Negative			
	L.F.	—	Negative			
54	R.H.	A.S.	Str. uberis	Penicillin 100,000 on 4 consecutive days.	No test carried out	
	R.F.	—	Negative			
	L.H.	A.S.	Str. uberis			
	L.F.	—	Negative			

Treatment with I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological	Period Tests Carried Out	Remarks
No. 200 50 c.c. all quarters	Clots all quarters	Negative A.S. Negative A.S. Negative A.S. Negative A.S.	3 weeks. Large clots persisted. Some blood	Evidence of fairly marked irritation of gland epithelium and tissue. Marked leucocytosis.
No. 197 80 c.c. all quarters	Clots all quarters, no clinical cure	Negative A.S. Negative A.S. Negative A.S. Negative A.S.	3 weeks. Gradual recovery. Clots persisted for 3 weeks	Cure after 3 weeks.
No. 200 50 c.c. all quarters	Large clots, some blood and serum-stained secretion	Negative A.S. Negative A.S. Negative A.S. Negative A.S.	Gland became markedly swollen, and secretion remained altered for 2 weeks	Treatment obviously caused marked irritation of epithelium and glandular tissue with cellular disintegration.
No. 197 50 c.c. in 3 quarters	Normal Normal Normal Normal	Str. uberis+ Str. uberis+++ Str. uberis+ Str. uberis+		No cure as revealed by bacteriological examination.
Sanders— 50 c.c. in 3 quarters	Normal Normal Normal Normal	Negative Str. dysgalactiæ++ Negative Negative	6 weeks. Few clots increased leucocyte content. Evidence of irritation in R.F.	Some irritation, R.F. quarter — still infected.
Sanders— 50 c.c. in 3 quarters	Normal Normal Normal Normal	Negative Negative Negative Negative	3 weeks	Complete cure.
No. 197 50 c.c. in all quarters	Normal Normal Normal Normal	Negative Negative Negative Negative		Complete cure.
Sanders— 100 c.c. all quarters	A.S. A.S. A.S. A.S.	Staph. pyogenes++ Negative Staph. pyogenes+ Negative	3 weeks. Altered secretion in all quarters. Trace of blood R.H. for 2 days. Gland swollen	
No. 201 30 c.c. in R.H. and L.H.	— — — —	Negative Negative Negative Negative		Complete cure. No signs of irritation
No. 201 20 c.c. diluted 20 c.c. light Liquid paraffin R.H. and L.H.	— — — —	Negative Negative Negative Negative	3 weeks. No further clinical evidence. No evidence of irritation	Complete cure
No. 197 50 c.c. all quarters	— — — —	Negative Negative Negative Negative		Complete cure

Case No.	Qtr.	PRETREATMENT FINDINGS Clinical	Bacteriological	Treatment Prior to use of I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological
55	R.H.	Clots	Negative	No previous treatment	—	—
	R.F.	—	Negative			
	L.H.	—	Str. dysgalactiæ			
	L.F.	—	Negative			

In addition to the above tests controlled by bacteriological examinations, reports have been received from Veterinary Surgeons who have used I.M.O. in their practices as a routine measure with success, as revealed by clinical appearances. 19 cases involving 54 quarters were treated on clinical appearances alone and all recovered quickly without further clinical evidence. Ten cases involving 12 quarters which had proved resistant to Penicillin and/or Sulphanilamide were treated with I.M.O.; 2 of these (3 quarters) gave a sharp reaction to I.M.O. followed by induration of quarters and reduced yield. No further clinical evidence of altered secretion was noted. The remainder responded well to the treatment. It would appear from the above findings that the possibility of iodine idiosyncrasy in the case of certain cows must be considered.

Treatment with I.M.O.	RESULTS OF TREATMENT Clinical	Bacteriological	Period Tests Carried Out	Remarks
No. 197	—	Negative		Complete cure
80 c.c. all quarters	—	Negative		
	—	Negative		
	—	Negative		

Abbreviations: A.S. = altered secretion. S.S.A. = slightly altered secretion. S.M.A. = secretion markedly altered. Mic. = micrococci. Dip. = Diplococci.

+=Fairly marked.
++=Marked.
+++=Very marked.

Conclusion

Reference is made to treatment with iodised mineral oil previously reported by Sanders in America.

The authors report on fifty-five cases of mastitis involving one-hundred-and thirty-nine quarters which were successfully treated with iodised mineral oil, including some which had persistently failed to respond to recognised forms of treatment.

Iodised mineral oil appears to be a therapeutic agent of considerable value in the treatment of infections of the bovine udder.

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COMPARISON OF THE EFFECT OF LENGTH OF HAIR ON THE PERSISTENCE OF D.D.T. CRYSTALS ON THE COATS OF CATTLE AND GOATS

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BRACEY (1950) observed that length of hair might have a notable influence on the persistence of D.D.T. crystals on sprayed cattle; two other trials were accordingly made with cattle at the Bristol University Veterinary Field Station, Langford, Somerset, and at the Allington Farm, Porton, Wiltshire.

Materials and Methods

An oil-bound suspension of D.D.T. crystals (T.P. 724) was applied by a Four Oaks Knapsack Sprayer and a dispersion containing 2.5 per cent D.D.T. was used in all cases.

Goat Experiment at Allington Farm

An attempt was made to apply as nearly as possible 500 mg./sq. ft. of D.D.T. over the plane surface of each animal. As the goats were about 3 feet in length with a torso about 9 inches deep, this worked out at roughly 10 sq. ft. of total area. Each goat was sprayed with 200 c.c. of 2.5 per cent D.D.T. suspension.

The goats were divided into three groups according to hair length: (*i*) Long, with hair from 1 to 6 inches long on the belly and 7 inches long along the back; (*ii*) medium, hair 1 to 4 inches long on the belly and 4 inches on the back; (*iii*) short. The goats with the longest hair are also the oldest; on young goats, although the coat is shorter, it appears to be thicker. As the goats grew older the hair became patchy in distribution and did not form the even-lengthed fleece as found on sheep. Six goats were assembled for each group from a large flock, and, after treatment, were maintained in separate pastures on the chalk downs. The latter are naturally dry and well drained and without very long vegetation. Goats, unlike sheep, lie down seldom, normally keeping on the move for fresh pasture. This characteristic of behaviour would tend to extend the residual life of D.D.T. deposits on the belly as compared with deposits on cattle.

Cattle Experiments at Langford

For the cattle experiments two groups were obtained according to hair length: (1) Six young bulls with hair averaging $\frac{1}{2}$ inch long, and (2) six Shorthorn heifers with hair averaging $1\frac{1}{2}$ to 2 inches, were sprayed all over with 2.5 per cent D.D.T. suspension.

Hair was collected in the manner already described (Bracey, 1950) and put with *Glossina palpalis* adults in mesh cages overnight.

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Results of Experiments

These are given in Tables I and II, and show the improved residual life of the D.D.T. on the long hair as opposed to the short hair; and of the back and sides of the torso as compared with the belly. The short-haired bulls were tethered for most of the time in a paddock and consequently spent much time lying down. The residual action of the D.D.T. on the cattle was very much shorter than on the goats. The experiments were conducted through July and August, 1950.

TABLE I

Toxicity to Glossina palpalis of hair cut at intervals from goats sprayed with D.D.T. crystals.

Number of Goats	Hair Group	Kill of tsetse flies from deposit aged in weeks							
		1	2	3	4	5	6	7	8
		Hair from belly						Hair from back	
6	Long	120/120	118/120	52/120	20/60	33/60	11/60	51/60	10/60
		Hair from belly					Hair from back		
6	Medium	100/117	111/120	55/120	6/60	9/60			
		Hair from belly			Hair from back				
6	Short	76/119	93/120	0/120	44/60	40/60	20/60	39/60	2/60

The results in Table I show how the hair from the belly lost its toxicity to *Glossina* sooner than the hair from the backs, and also that the longer the hair the greater the residual toxicity. An interesting feature was the greater difference between the residual life of the hair from the belly as compared with that from the back in the short-haired group than in the long-haired group.

The data from the cattle trial shows again (Bracey, 1950) the very short life of DDT crystals on the belly of cattle. The short-haired group were three pairs of identical twins, of which one pair was Welsh Blacks, a particularly short-haired variety.

TABLE II

Toxicity to Glossina palpalis of hair cut at intervals from cattle sprayed with D.D.T. crystals

Number of Cattle	Hair Group	Deposits Age in days	Hair Site	No. flies killed	No. flies used
6	Long	14	Belly	40	60
6	Long	21	Belly	16	60
6	Long	28	Back and Sides	48	60
6	Long	35	Back and Sides	9	60
6	Short	14	Belly	17	60
6	Short	21	Belly	0	60
6	Short	28	Back and Sides	32	60
6	Short	35	Back and Sides	12	60

Taking the data as a whole it appears evident that a method must be found of sticking insecticides very effectively to cattle hides, if there is to be any prospect of killing alighting *Glossina* for any considerable length of time after spraying the cattle.

One could not expect to repeat precisely these results in a tropical climate because the different climatic factors would exert some effect. During the period of the goat trial, over the first half the maximum temperature ranged from 57° F. to 74° F., rainfall was 4.37 inches, and sunshine 195.3 hours; in the second half of the period maximum temperature ranged from 62-75° F., rainfall was 4.01 inches and sunshine 185.0 hours.

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SOME OBSERVATIONS ON THE "SPRING RISE" IN WORM-EGG COUNTS OF HALFBRED SHEEP IN SOUTH-EAST SCOTLAND

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Introduction

In 1944 observations were started on Scottish hill sheep to determine the seasonal variations in their worm burdens, so that prophylactic dosing programmes could be designed to remove the worms when they are most numerous or when the host is most likely to be susceptible to damage from them.

It was not until late 1950, after it had been found that the "spring rise" in worm-egg output in Scottish hill sheep is caused by an increase in the worm burden, that the first preliminary comparable observations were made on two

flocks of Halfbred ewes to determine whether the same increase in worm-egg output occurs in sheep on marginal and low ground in Scotland.

Methods

Fæces were collected from ewes or lambs and the worm-eggs were counted by the modified technique of Gordon and Whitlock (1939) described by Morgan and his co-workers (1950). The eggs of *Strongyloides* spp. and of *Nematodirus* spp. were counted separately from those of the so-called "Other Strongyles." With this method each egg counted is multiplied by 50 to give eggs per gram.

Results

1950-51.

On one farm ("A"), where lambing began early in March, worm-egg counts were made on the ewes periodically from the autumn of 1950 until August, 1951; the ewes were also weighed and samples of fæces collected from the lambs in early and late May. On the other farm ("B") samples were collected from the ewes about five weeks before the beginning of lambing—February 10—and again a little over a month after lambing ended.

The average counts of the ewes on Farm "A" were less than 25 worm-eggs per gram. of fæces from the first sampling in October until January; they had not been dosed for worms since the second week of July, 1950. By the end of February the counts had increased gradually to 170 per gram although 24 of 52 ewes still had counts of 50 or less. After the end of lambing, on April 13, the average worm-egg count was 560; it fell to 300 early in May, and to under 70 early in June; by August the average count was less than 20 eggs per gram.

On Farm "B" the average worm-egg count of the ewes was about 40 early in February and 1,025 in the middle of May.

On Farm "A" the weight of the ewes increased from an average of 182 lb. at the end of October to about 200 lb. before lambing. Early in April the average weight was 152 lb.; between the beginning of May and the beginning of July there was an increase from about 155 lb. to 186 lb.; during the next five-and-a-half weeks they lost an average of 13 lb.

These observations, made in 1951, showed that there is a "spring rise" in worm-egg output in Halfbred ewes in South-East Scotland, but there were insufficient data to show the influence of the date of lambing on the date of the "spring rise." Observations on a hill farm in Ettrick had shown that the "spring rise" in worm-egg output occurred earlier in those ewes which lambed in the first ten days of the lambing period than in those which lambed subsequently; the same observation has been reported by other workers (Leiper, 1951). Observations on Scottish hill sheep have shown, however, that the "spring rise" also occurs in hoggs and wethers, and therefore is not dependent on pregnancy.

1952.

In 1952, observations were continued on Farm "A," where periodic worm-

egg counts were made on some ewes, including counts made within a few hours of lambing. Worm-egg counts were also made periodically on two other farms ("C" and "D") on groups of early and of late-lambing gimmers and ewes. On Farm "C" six counts were made between mid-January and mid-April and on Farm "D" four counts were made within the same period.

On Farm "A" the worm-egg counts in the ewes rose from an average of 25 per gram of fæces on February 11 to an average of 250 on February 27. The average count of the ewes which were sampled a few hours after they lambed was 670, but it is probable that the output of fæces then might be less than normal. The average count had dropped to 115 by April 11, and a month later it was only 20.

Table I shows the average worm-egg counts on Farms "C" and "D," where early and late lambing ewes and gimmers were observed.

On Farms "C" and "D" there were a few appreciable counts of eggs of *Strongyloides papillosus* (which shows a spring rise) in some of the gimmers; the counts are included in Table I.

TABLE I

The average number of Worm-Eggs per gram of fæces of early and late Lambing Gimmers and Ewes on two farms

Date	Farm C. Lambing		Farm D. Lambing	
	Early	Late	Early	Late
January 17	42	24	—	—
„ 31	—	—	137†	60
February 4	54	26	—	—
„ 19	116	43	—	—
„ 25	—	—	62	97
March 3	111	81	—	—
„ 17	298	134	—	—
„ 28	—	—	527	44
April 10	345	906*	—	—
„ 17	—	—	283	254

*Excluding one ewe with an exceptionally high count the average was 219.
†Excluding one ewe the average was 45.

1953.

The results in 1952 confirmed that the marked spring increase in worm-egg production occurs earlier in the early lambing ewes than in the late lambers, but did not give a clear indication of the time at which prophylactic dosing of Halfbred ewes would be most likely to be beneficial. In 1953, therefore, samples were collected from early and late lambing gimmers and ewes on eight farms (A, B, C and D again and E, F, G and H), which lie between the Pentlands and the Berwickshire coast. The first series of samples from early and late lambers were collected when those sheep which were due to lamb during the first week were being drawn into the lambing field. On six of these farms the

early and late lambers were sampled again towards the end of the lambing period; these worm-egg counts were thus made early in March and during the first half of April.

On farm " D " there were some ewes which had lambed in mid-February; counts were made from them only after lambing.

The average worm-egg counts of the early and late lambing ewes and gimmers on each farm are shown in Table II.

In March, 1953, the average worm-egg count of 243 gimmers and ewes due to lamb in the following week was 129, but the average of 245 sheep more than a fortnight from lambing was only 72.

TABLE II

The average number of Worm-Eggs per gram of fæces of early and late Lambing Gimmers and Ewes before and after lambing

Farm	Date of Sampling. March	Lambed about a fortnight previously	Due to lamb in 2-10 days	Due to lamb in about a fortnight or 3 weeks	Date of Sampling. April	Lambed 4-6 weeks	Lambed under a month
A	2nd	—	40	55	—	—	—
C	4th	—	137	87	15th	91	179
D	4th	372	76	59	9th	313	276
E*	5th	—	166	59	9th	61	150
F†	9th	—	274	85	—	—	—
G	11th	—	233	93	10th	518	313
B	18th	—	42	37	20th	198	56
H	19th	—	45	—	16th	168	383

*Dosed with copper sulphate immediately followed by 2 fl. oz. phenothiazine in late January or early February.

†All gimmers.

In Scottish hill sheep the worm-egg counts of gimmers in spring tends to be higher than that of ewes, but in these Halfbreds only 8.1 per cent of the 370 gimmers had worm-egg counts of 500 or more in winter and early spring, whereas 8.6 per cent of 1,081 ewes had counts of 500 or more; however, on some farms Halfbred gimmers are not tupped so early as are the ewes.

The spring and early summer worm-egg counts of hill sheep are considerably higher following a severe winter than they are after a mild winter. Halfbred ewes may suffer almost as much as hill sheep from the cold and rain, but they are less likely to suffer from malnutrition to the same extent. The winter and spring of 1951 was very severe, but the winters and springs of 1952 and 1953 were mild in South-East Scotland. Table III, which shows the percentages of sheep with various levels of infestation before lambing, is based, therefore, on one spring when the counts might be expected to be higher than normal and on two springs when they were probably lower than normal. The results on the two farms (A and B), which were sampled in 1951 and in the following years, confirm this.

TABLE III

The percentages of In-Lamb Gimmers and Ewes with different levels of infestation

Date	Expected weeks before lambing	Number of Farms	Number of Sheep	Worm-egg counts (S. N. OS.) 0-50	100-450	500-950	1,000-2,000
January							
15-31	8 or less	3	59	79.7	18.6	0	1.7
	9 or more	3	58	86.2	13.8	0	0
February							
1-16	4 or less	3	53	67.9	32.1	0	0
	5 or more	4	74	73.0	27.0	0	0
17-29	2 or less	4	68	61.8	32.4	5.9	0
	3 or more	4	67	62.7	34.3	3.0	0
March							
1-15	1 or less	7	206	50.0	43.2	4.9	1.9
	2 or more	7	250	66.0	32.8	1.2	0
16-31	1 or less	4	93	69.9	30.1	0	0
	2 or more	1	16	75.0	25.0	0	0

S = Strongyloides; N = Nematodirus; OS = other strongyles.

Table IV gives similar data for gimmers and ewes after lambing.

In Scottish sheep the nematode eggs of the alimentary tract can be divided into those of *Nematodirus* spp. and of " Other Strongyles," and of *Strongyloides papillosus, Capillaria* spp., *Trichuris ovis,* etc. Except in Down Cross lambs, in which infestations of *Nematodirus* spp. can be of considerable pathogenic importance in June, only the " Other Strongyles " are important.

In 1951 and 1952 cultures were made from the fæces from farms A, B, C

TABLE IV

The percentages of Lambed Gimmers and Ewes with different levels of infestation

Date	Weeks since lambing	Number of Farms	Number of Sheep	Worm-egg counts (S. N. OS.) 0-50	100-450	500-950	1,000-2,000	Over 2,000
March								
1-15	About 2	1	29	24.1	51.7	17.2	0	6.9
16-31	2 or more	2	42	14.3	66.6	7.1	9.5	2.4
April								
1-15	4 or more	7	187	35.3	46.0	12.8	4.3	1.6
	3 or less	7	163	25.8	63.2	8.6	0.6	1.8
16-30	3 or more	3	59	33.9	57.6	6.8	0	1.7
	2 or less	3	54	55.6	33.3	5.6	3.7	1.8
May								
1-31	Over 8	3	39	56.4	28.2	10.3	5.1	0
	8 or less	4	61	39.3	34.4	11.5	6.6	8.2

S = Strongyloides; N = Nematodirus; OS = other strongyles.

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and D and the larvæ from them identified, in order that the proportions of the "Other Strongyles" could be determined.

In January and February over 80 per cent of the larvæ were those of *Trichostrongylus* spp., and in some cultures over 90 per cent were of this genus; the remainder of the larvæ were of the genera *Ostertagia, Hæmonchus, Bunostomum, Chabertia* and *Oesophagostomum.* Late in February or in March the percentages of *Ostertagia* and the other species increased, and a few larvæ of *Cooperia* spp. were found, but in most cultures the larvæ of *Trichostrongylus* spp. were still more numerous than all the other species combined, and the proportion tended to increase again during the summer. The sequence of species seemed to be somewhat similar in Halfbred hoggs.

Even allowing for the facts that *Nematodirus* spp. are not prolific egg layers, and that there is a marked age immunity to this genus, the egg counts of *Nematodirus* spp. in the gimmers and ewes were surprisingly low, considering that these worms may be very numerous in lambs. In February, March and April, eggs of *Nematodirus* spp. were found in only 2.8 per cent of the ewes and in the same percentage of the gimmers.

Further evidence that the main onset of the "spring rise" in worm-egg production in Scottish ewes on low ground occurs at or soon after parturition, was furnished by a small flock of Blackfaced sheep in Banffshire, which had been tupped by a Border Leicester, and which was sampled twice in March, and again in May. The second sampling in March was two days before lambing was due to begin. These sheep were running on improved pastures and roots and were in very good condition. The average worm-egg counts of these gimmers and ewes was 42 and 65 on March 3 and 17 respectively and 181 on May 14.

In 1951 some worm-egg counts were made on lambs from flocks A, B and C.

In flock "A" worm-egg counts of the lambs rose from an average of 300 early in May to over 1,100 later in that month; a little over half of these eggs were those of *Nematodirus* spp. These lambs were in three fields, and there were considerable differences between the averages in the different fields, the range being from 60 to 780 eggs per gram of fæces early in May and from 730 to 1,230 late in May; those which were highest early in May were lowest later in that month.

Late in May some lambs, which were not thriving, on Farm "B" were sampled; their average counts were 150 *Strongyloides,* 1,900 *Nematodirus* and 1,150 "Other Strongyle" eggs.

On a third farm ("C") worm-egg counts were made on some Down Cross lambs on June 22. They were made in order to compare the worm-egg counts on a field of young grass and on a field of 6-year-old grass, where the lambs were thriving, with those on a field of 5-year-old grass, where the lambs were not thriving and where a few had died. On the young grass field the average egg counts were 36 *Nematodirus* and 114 "Other Strongyles," on the 6-year-old grass the average egg counts were 334 *Nematodirus* and 400 "Other Strongyles," and on the 5-year-old grass the average egg counts were 3 *Strongyloides,* 323

Nematodirus, and 189 " Other Strongyles." All the lambs had been given a double dose of phenothiazine a month before and " Copper-nicotine " eight days before these samples were collected.

In hill sheep the highest counts of *Nematodirus* spp. are found in late winter in hoggs. Therefore, in 1952 and in 1953, 65 Halfbred hoggs were sampled during winter or late spring to determine whether, or not, they were acting as reservoir hosts for helminths of this genus; no *Nematodirus* eggs were found. The average counts of the " Other Strongyles " varied from 66 to only 335 per gram, although the majority of the hoggs in the flock which gave the highest averages were scouring severely.

Discussion

Observations made on Halfbred gimmers and ewes in South-East Scotland have shown that there is a " spring rise " in worm-egg output, and that its onset is closely correlated with the date of parturition.

Cultures of the fæces of these sheep have suggested that *Trichostrongylus* spp. are the commonest bursate nematodes, and that *Ostertagia* spp. are less prominent than in hill sheep in their contribution to the " spring rise "; confirmation of this inference by post-mortem worm counts is necessary, however.

Lowground farmers have been advised to dose their ewes shortly before lambing time. Phenothiazine, Carbon tetrachloride and " Copper-nicotine " are the principal anthelmintics in use in Scotland at present, but manufacturers warn against their administration within about a month of lambing. This contradictory advice sometimes is " reconciled " in practice by dosing a few weeks before lambing. The data given in this paper suggest that, until safe anthelmintics which will remove immature stages are available, Halfbred ewes on well managed farms in South-East Scotland cannot in normal years be aided to any great extent by anthelmintic treatment before lambing. This statement does not refer to flocks which are " doing badly," either because of severe weather or because of bad management, nor to the occasional gimmer or ewe which is not thriving in a flock of otherwise healthy sheep. In 1953 a comparison of the worm-egg counts between the sheep on two carefully herded high-lying Berwickshire farms, on one of which the sheep had received anthelmintic treatment, suggested that the anthelmintic and the labour of dosing had been wasted.

The worm-egg counts of the lambs show that the build-up of their infestations is very rapid in May.

Only a few observations were made, but these suggest that it is unlikely that contamination of the pastures by hoggs or older sheep in late autumn, winter or spring could cause the heavy infestations of *Nematodirus* spp. which frequently occur on pastures of over a year old; if this is so, the eggs or larvæ must survive on the pastures from one summer until the next spring and in the case of *Nematodirus* spp. this is probable.

However, the ewes are undoubtedly the reservoir hosts for some species, and therefore it is most important that their worm burdens be reduced before they contaminate the pastures which they and their lambs will graze after they

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leave the lambing field. This can perhaps be done by dosing the ewes as they are put with their lambs on to their summer grazings, and by subsequently mixing small quantities of phenothiazine in their food and that of their lambs to reduce the egg output of the worms and to reduce the number of infective larvæ developing from the eggs. A trial on these lines, carried out at the Veterinary Research Station at Thurgarton in Nottinghamshire, suggested this routine, but at Thurgarton the ewes were dosed before lambing (Leiper, 1951). One Berwickshire farmer has tried this routine and found it practicable, although it adds to the shepherd's work during lambing time, which is his busiest period. If ewes are being trough fed with about ½ lb. oats, etc., each day, about ¾ lb. of phenothiazine should be well mixed in each hundredweight; this should be sufficient to reduce worm-egg output and the viability of any larvæ which do hatch. A less laborious method, which also represents a safeguard against overdosing, might be to sprinkle the phenothiazine at a rate of about 2 ozs. per three score of sheep evenly over the food in the troughs; until the sheep become accustomed to the taste of phenothiazine, and in windy weather, it is, however, probably better to mix it in the feed. It is most unlikely that these methods of administration of phenothiazine by feeding would result in a craving comparable to that noticed by Swales (1942) in occasional sheep which had access to mineral mixtures containing phenothiazine and salt; this "addiction" was attributed in a very few cases to the phenothiazine rather than to the salt. However, it does seem more likely that the phenothiazine might depress the appetite of the ewes and lambs, if it is assumed that very small daily doses could have the same effect which Gordon (1953) has found with larger single doses. The results of Allen and Kyles (1951) suggest that this might occur and that after a few weeks care should be taken to see that no lambs are being checked by the treatment. It was observed on the Berwickshire farm that, when lambs were being fed at a rate of about double that mentioned above, they tended to lie near the boxes and grazed less than usual. So far controlled experiments on this routine have not been made on Halfbred sheep in South-East Scotland though such experiments are urgently required. The observations made in Berwickshire suggest that it is possible that too prolonged treatment or too heavy a dosage rate may "check" the lambs, but that when treatment ceases they thrive. Information is lacking on the length of time during which this treatment should be continued.

Observations are required on whether there are farms where even light infestations of *Trichostrongylus* spp. *Bunostomum trigonocephalum,* etc., justify autumn dosing, to remove infestations which may be a debilitating factor during the winter and a source of contamination of pastures in late winter and spring. These farms are most likely to be where the sheep are frequently in poor condition in the spring.

The present trend of prices and of consumer requirements demand that farmers produce small joints. Down Cross lambs must, therefore, be given careful husbandry so that they can be slaughtered as lambs; in order to do this helminth parasitism must be controlled before it acquires proportions which will

affect the condition of lambs. On the other hand if, because of helminths or other causes, growth is unsatisfactory they must be marketed as stores, to be wintered and slaughtered as heavy weight hoggs.

Acknowledgments

We wish to express our sincere thanks to the farmers and shepherds who helped in the collection of data, often when they were very busy and most disliked their sheep being handled. We should especially like to thank Mr. T. C. Hinton of Fulfordlees for having tried the practicability of feeding phenothiazine in the trough feed, and for much valuable advice and suggestions.

We also wish to thank Dr. D. O. Morgan for his help and advice.

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Summary

Worm-egg counts on Halfbred ewes in South-East Scotland show that the date of parturition has a marked influence on the date of the "spring rise" in worm-egg output. This suggests that anthelmintic treatments should be given based on the date of lambing, and that pre-lambing treatment of Halfbred ewes may not be justified, except in single cases, or where the flock is losing condition as a whole.

Larvæ of *Trichostrongylus* spp. in cultures of Halfbred ewe fæces were more numerous than those of oother genera.

On many farms contamination of pastures in the previous year is probably a greater cause of heavy infestations of *Nematodirus* spp. in Down Cross lambs than infestations caused by contamination of pastures with eggs of *Nematodirus* passed by ewes during winter or spring.

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A NEW TYPE OF CANINE ARTIFICIAL VAGINA

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Introduction

DURING the course of certain work in this Department it was necessary to obtain supplies of fresh canine semen. Adult dogs were obtained, and the problem arose as to how to collect the semen in an expeditious and hygienic a manner.

Study of the relevant literature revealed a variety of methods for collection, those most commonly used being either digital manipulation or some form of artificial vagina.

Another method that has been tried is electrical ejaculation similar to that first devised by Gunn for use on rams. In our hands the adaptation of this technique to dogs was unsatisfactory in so far as evoking ejaculation and quality of semen are concerned. Where, in the few cases we were successful in obtaining an ejaculation, the semen was contaminated with urine.

Digital manipulation was tried first as no special apparatus was required, but the method is objectional on æsthetic grounds and was inadequate in respect of quantity and quality of semen obtained, the volume amounting to about 2 c.c.s only.

It was therefore decided to try collection by means of an artificial vagina said to be of " Danish " design and claimed by the supplying firm to be satisfactory. This instrument, however, was unsatisfactory, primarily because of the extremely small calibre of the tube.

A ram-artificial vagina (Cambridge pattern) was next tried, and, while this was partially satisfactory, it did not entirely meet our requirements, the primary deficiency being lack of physical sensation.

In view of the shortcomings of the existing apparatus for the collection of semen from the dog which have been outlined above, an artificial vagina was designed which would more nearly meet the requirements in view. After a series of trials, the type of artificial vagina now to be described was evolved.

Description of a New Canine Artificial Vagina

A bovine artificial vagina (15 inches long, $2\frac{1}{2}$ inches wide) was cut in half, this gave ample length and calibre to accommodate the largest dog. A latex lining was fitted and hot water introduced between the cover and the lining in the usual way.

The lumen of the artificial vagina is capable of being adjusted to the size of the dog by varying the amount of water. Collections from some dogs, by means of the apparatus so far described, were moderately successful, but, in the absence of a " teaser " bitch, the dogs after a few collections appeared to lose enthusiasm.

FIG I

LONGIT. SECTION.

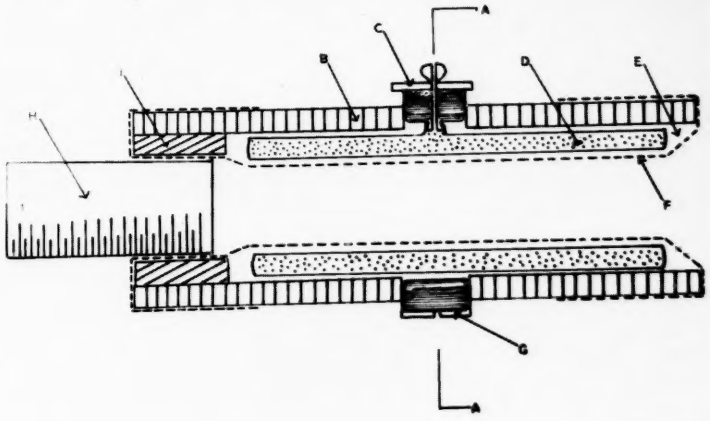
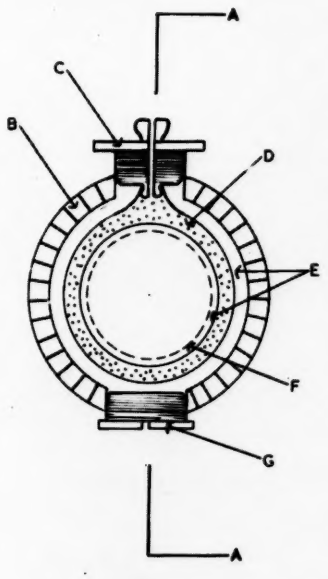


FIG II

CROSS-SECTION. A—A IN FIG I



Figs. I and II.

B. Rubber wall of artificial vagina.

C. Inlet for air to inside bladder.

D. Air inflated bladder.

E. Space for hot water.

F. Latex lining for artificial vagina.

G. Inlet for hot water.

H. Graduated collecting jar.

I. Solid rubber fitting to hold collecting jar.

(*Article by Harrop, page 194*)

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Fig. 3
Apparatus used—Component Parts.

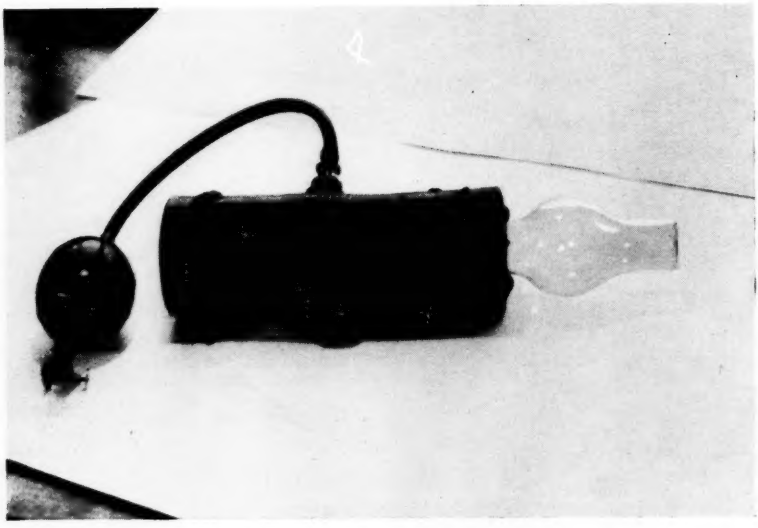

Fig. 4
Apparatus Assembled for Use.

(*Article by Harrop, page 194*)

A considerable number of modifications and elaborations were made; a cylindrical bladder was finally evolved and this was fitted inside the artificial vagina in the water space and was connected to the exterior by a simple two-way valve through which air could be pumped. The introduction of the bladder and valve fulfilled a two-fold purpose (a) the size of the lumen could be varied according to the amount of air pumped in, and (b) a pulsating movement could be imparted to the lining of the artificial vagina by shutting off the supply of air but continuing the pumping (see Figs. I and II).

A Higginson's enema syringe was used to act as a pump, air being cut off when necessary by the use of a spring clip on a piece of rubber tubing attached to the inlet end of the enema syringe (see photograph).

Technique for Collection

After filling with warm water and adjusting the lumen to the size required, the liner is lightly lubricated with vaseline.

The glans penis of the dog is stimulated to swell by digital manipulation and the penis is quickly directed into the artificial vagina; at this stage, no ejaculation has yet taken place. The operator holds the penis in position with two fingers behind the swollen glans, at the same time holding the artificial vagina in the other hand. Simultaneously an assistant gently presses the pump and thereby causes a pulsating movement in the lining of the artificial vagina.

Collection continues in this manner for periods varying from 15 to 30 minutes according to the individual dog; the whole of the ejaculation is collected and this differs from the amounts collected by other methods.

So far about 50 samples of semen from various dogs have been collected in this manner without the aid of a "teaser" bitch.

The amounts of the ejaculates have varied considerably, not only with different dogs but also with the same dog on different occasions, but an average amount collected from the 50 dogs is about 10 c.c.s per dog, per ejaculation.

Some dogs, when used repeatedly, regard the artificial vagina without any apprehension or inhibition, and will ejaculate into it with little or no prior stimulation.

Acknowledgments

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A REVIEW OF KNOWLEDGE AVAILABLE CONCERNING DIGESTION IN DOMESTIC HERBIVORA

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PART II

The rate of passage of food residues.

This important aspect of the digestive mechanism has recently been re-investigated by Balch (1951) whose paper includes a comprehensive review of earlier work. Balch elaborated the technique described by Lenkeit and Halbeck (1930) who measured the rate of excretion of stained food residues. Balch found that 80 per cent of the food residues were excreted between 70-90 hours after administration and that ground plus unground hay was excreted faster than unground alone. A diet composed solely of ground hay was excreted over a longer period than one of unground hay. These differences were due to changes in the movement of food in the reticulo-rumen. He suggested that a decreased rate of passage through the reticulo-rumen was associated with an increased digestion of crude fibre. Food residues traverse the digestive tract of the horse at almost twice the speed taken by the cow. Using carbon granules as a marker Alexander (1946) found that granules first appeared 22 hours after feeding and were completely excreted by 48 hours. This rate of passage of food in the horse has been confirmed by radiological methods (Alexander and Benzie, 1951). Since horses are only about one third less efficient than ruminants in digesting fibre (Morrison, 1950; Armsby, 1917), the rate of digestion must be much faster. It seems reasonable, therefore, to suggest that the horse would be a useful experimental animal for the study of cellulose digestion.

Watson and Jarrett (1944) have studied the course of liquids through the stomach of sheep at various ages from birth to maturity and the effect of copper salts on their course. They stated that the œsophageal groove reflex resulted from mechanical stimulation of the mouth, pharynx or both.

Products of digestion.

Tappeiner (1884) identified the products of cellulose digestion by rumen bacteria as acetic, butyric and other higher acids. However, the importance of

these substances to the ruminant was not fully realised until the last decade. This omission was largely due to efforts to implicate glucose as the carbohydrate absorbed and metabolised by the ruminant. However, by 1938 Woodman (Woodman and Evans, 1938) had abandoned the hypothesis that glucose was the absorbed product of cellulose digestion (Woodman, 1930), and confirmed the earlier worker's finding that the lower fatty acids were the principal fermentation products formed from cellulose by rumen bacteria. McAnally and Phillipson (1942) then showed that blood from the ruminal, reticular, omasal and cæcal veins contained more volatile fatty acid than the peripheral blood and that starch, sucrose and glucose were fermented with the production of the same acids. With sucrose and glucose there was a transient appearance of lactic acid. It is of interest to note that Johns (1951) recently isolated an organism from the rumen which fermented lactate with the production of proprionate. The same organism (Veillonella gazogenes) occurs in the horse's colon (Alexander, MacPherson and Oxford, 1952).

The clearance from the blood of injected acetate, propionate and butyrate has been studied by Jarrett, Potter and Filsell (1952) who found that the concentration in the blood of propionate fell much more quickly than that of acetate or butyrate. Of these three fatty acids only acetate failed to increase the concentration in the blood of glucose, lactic or pyruvic acids.

Propionic acid being a 3-carbon compound is probably a precursor of glycogen. This is supported by the work of Jarrett and Potter (1950) who found that, in sheep, only propionate increased the concentration in the blood of sugar, pyruvate and lactate. Reid (1950) found that injected propionate relieved insulin hypoglycæmia in sheep as quickly as the injection of glucose. Further evidence of the glycogen-forming property of propionate was provided by Hitchcock and Phillipson (unpublished) who found that phloridzinised sheep excreted equivalent amounts of glucose in the urine. Sijpesteijn and Elsden (1952) have shown that rumen bacteria can convert succinate into propionate.

The metabolism of the small amount of butyric acid formed in the rumen may be accounted for in part by the formation of ketone bodies by the rumen wall (Pennington, 1952); the remainder probably forms carbohydrate (Buchanan, Hastings and Nesbett, 1943). Potter (1952) found that intravenous injections of butyrate relieved hypoglycæmia in ewes, lambs and rabbits.

From the work of Popjak, Folley and French (1949) it appears that the large concentration of low molecular fatty acids in cow's milk fat is synthesised in the mammary gland mainly from the acetic acid in the blood. This has been confirmed by perfusing the isolated bovine mammary gland with heparinised blood containing labelled acetate (Cowie *et al.*, 1951). These workers also found that acetate carbon was incorporated into lactose by some mechanism other than CO_2 fixation, and that cholesterol was synthesised in the udder. Reid (1950) has shown that 90 per cent of the volatile acid in sheep's blood is acetic. The role of the lower fatty acids in milk secretion has been reviewed by Folley (1949). Folley and French (1949, 1950) compared the utilization of acetic acid in the presence of glucose by mammary tissue from the cow, goat, sheep, rabbit and

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rat. The ruminant tissues metabolised acetate much better than those of non-ruminants. The arterio-venous difference in acetic acid concentration observed by Reid (1950) between the carotid and jugular blood showed that acetate was used by the tissues of the head. Villee and Hastings (1949) found that the rat diaphragm metabolised acetate and this metabolism was unaffected by insulin. Further Lipson, Omachs and Carest (1951) using labelled acetate, demonstrated the utilization of acetate by the dog's gastrocnemius muscle. The acetate metabolism was increased by stimulating the muscle, and acetate did not enter the muscle glycogen. Acetate metabolism has been fully reviewed by Bloch (1947).

It appears from the work of Greeley (1947) that in the goat insulin mediates the storage of carbohydrate. He also found that after removal of the pancreas fasting did not cause ketosis.

The heat increment produced by cows after feeding exceeded the basic heat production by 50-100 per cent (Ritzman and Benedict, 1938). These authors considered it unlikely to be the result of fermentation since it also occurred in the horse and elephant. They supposed that considerable time had to elapse in the horse before food reached the large intestine. However, an increase in fatty acids in the horse's cæcum has been found within 3 hours of feeding (Alexander, 1952). Further, Alexander and Benzie (1951) demonstrated radiologically the rapid propulsion of barium through the stomach and small intestine of the weaned foal, reaching the cæcum within 2 hours of feeding. The objections raised by Ritzman and Benedict (1938) in attributing the heat increment after feeding in the horse to fermentation are, therefore, no longer valid. The heat increment of feeding in ruminants is due to the quantitative importance of acetic and butyric acids as products of digestion (McClymont, 1952). McClymont considers the high specific dynamic action of acetic acid due to its being non-glycogenic, not used for protein synthesis and being oxidised by most tissues; it is not stored.

Nitrogen metabolism in the ruminant has been reviewed by Krebs (1937) and McNaught and Smith (1947). The evidence for the conversion of ammonia nitrogen to protein has increased. Mills, Lardinois, Rupel and Hart (1944) confirmed the necessity of ample starch for this protein synthesis and found it to be superior to simple sugars. This may explain the significance of the holotrich ciliates, among the most obvious of the micro-organisms in the sheep's rumen, which Oxford (1951) has shown to be capable of making a glucosan from glucose, fructose and sucrose. This glucosan has been isolated from protozoa withdrawn from the rumen. It has also been found that if ammonia is to be converted into protein, the protein content of the ration must be low (Wegner, Booth, Bohstedt and Hart, 1941*a* and *b*). Additional evidence of the synthesis from urea and subsequent utilization of amino-acids has been provided by Loosli, Williams, Thomas, Ferris and Maynard (1949*a*). These authors also found that sheep and goats produced similar amino-acids from three different diets (1949*b*). In connection with the feeding of urea, it is of interest to note that Clark, Oyaert and Quin (1951) found that the introduction of urea into the rumen inhibited motility. An inhibition lasting 3-48 hours was produced by 10-20 gm., the

smaller dose being effective on a poor diet and sometimes spasms and collapse were produced. Comparing the substitution of urea for blood-meal in lactating cows Owen, Smith and Wright (1943) calculated that the efficiency of utilization of urea nitrogen was 75 per cent that of blood-meal nitrogen. Thomson, Graf, Eheart and Holdaway (1952) found that urea and cottonseed meal were of comparable value for milk production and the addition of 22 g. methionine per cow to the diet had no effect.

Shazly (1952*a*) determined the concentration of the various volatile fatty acids and of ammonia in the rumen at various times after feeding. An increased concentration of ammonia was correlated with increased concentrations of isobutyric and C_5 acids which he considered to arise from microbial attack on protein in the rumen. In a further paper (Shazly, 1952*b*) it was shown that the main products of the action of rumen micro-organisms on casein were ammonia, CO_2 and volatile fatty acids. The power of the rumen micro-organisms to deaminate amino acids depended on the animal's diet. McDonald (1952) found that the solubility of the protein determined the rate at which it was attacked by the rumen organism, zein, for example, being relatively insoluble was only slowly digested. He found when casein was fed the main non-protein nitrogen in the rumen fluid was ammonia. The ammonia produced by the deamination of protein is utilized by rumen organisms to build microbial protein. However, this may be a wasteful process for Chalmers and Cuthbertson (1950) showed that casein was utilized better when introduced directly into the duodenum than when fed into the rumen. Further, Bonnazzi (1951) found that the horse, a colon fermenting herbivore, digests more protein than a cow. However, the importance of the nature of the protein fed, to ruminants is shown by Chalmers and Synge (1950) who found a greater retention of nitrogen when herring meal was fed than when casein formed the protein supplement. Lewis (1951) found that nitrate was reduced in the rumen to ammonia and that sodium nitrate or nitrite in the rumen gave rise to methæmoglobinæmia.

Since methionine is essential to man and the common laboratory animals and as wool contains a large proportion of cystine, the sulphur requirements of ruminants are of great interest. Ferrando (quoted by Owen, 1951) maintained sheep in health on diets containing thioglycollic acid. This substance cannot be substituted for cystine in the rats' diet. Further, Reid, Moir and Underwood (1949) have provided some evidence that the sheep can obtain methionine micro-biologically. Recently, Thomas, Loosli, Williams and Maynard (1951) showed that sulphur deficiency could be produced in sheep and when this occurred, urea nitrogen was not utilized and wool growth decreased. It is now clear that ruminants can utilize inorganic sulphur to synthesise cystine and methionine. Block and Stekol (1950) fed sodium sulphate containing radio-active sulphur to cows, collected the milk for several days and isolated the proteins. Cystine and methionine, containing radio-active sulphur were isolated in appreciable amounts. Further, Hale and Garrigus (1953) showed the synthesis by sheep of cystine from elemental sulphur and sulphate sulphur.

Digestion in the cæcum and colon has been studied by Trautmann and his collaborators using a histological technique, Trautmann and Ascher (1941*a*) examined microscopically strips of onion epidermis after suspension for different periods in the goat's cæcum. They were only able to detect digestion after the onion epidermis had been in the cæcum for a period of 8 hours, and, since they regarded 3 hours as the normal time for digesta to stay in the cæcum, the cæcal digestion of cellulose was considered to be of little importance. In another paper the same authors (Trautmann and Ascher, 1941*b*) showed that the treatment of the onion epidermis with dilute acid or carbonate before introducing it into the cæcum, improved cæcal digestion, although, they still regarded it as negligible. However, more recent work (Gray, 1947) showed that 30 per cent of the digestible cellulose in the diet was digested in the cæcum and colon. The importance of the large intestine as a site of fermentation is well demonstrated by Elsden *et al.* (1946); these authors found large amounts of volatile fatty acid in the cæcum and colon of many species including the horse and ruminant. Relative to the size of animal they found greater amounts in the horse than in the ox. Alexander (1952) determined the total fatty acid concentration in the horse cæcum and colon under different conditions. He found the concentration of fatty acid decreased on withholding food and increased with feeding. The separation of the component acids showed an interesting difference between the mixture in the ventral colon and that in the dorsal colon. More propionic acid appeared to be produced in the ventral than in the dorsal colon, and more butyric and higher acids in the dorsal than in the ventral colon. The reason for this difference may be that the subtrate differs in the two sites of fermentation, the more soluble material being fermented in the ventral colon and in this connection it is interesting to note that the dorsal and ventral colons of the horse support entirely different populations of ciliate protozoa (Adam, 1951). The microbiological activities of the large intestine are clearly worth further study.

The digestion of fat by ruminants has not been studied to any great extent. Aylward, Blackwood and Smith (1937) fed iodised fat to cows and found its absorption slow and continuous, the blood concentration reaching a maximum 36-48 hours after feeding, and falling gradually for five days. In a study of the blood constituents after feeding fat, only lipin and acid-soluble P showed a change whilst lipin P was decreased by fasting (Aylward and Blackwood, 1936). Huff, Waugh and Wise (1951) have shown that the absorption of lipids by calves is assisted by the presence of glycerol-monostearate.

There can be little doubt that important diseases in ruminants and horses are caused by abnormal fermentations, tympanites in cattle and some colics in the horse, are obvious examples. These provide additional reasons for the close study of microbial digestion. Some studies of pathological fermentations have already been made. Hungate *et al.* (1952) found that feeding excess grain or introducing quantities of glucose into the rumen changed the microbial population. This treatment decreased the numbers of cellulytic organisms, increased the Gram + organisms and killed the protozoa. The total volatile fatty acid concentration decreased, motility was inhibited and death occurred in a

high proportion of animals. Clark and Weiss (1952) consider bloat in cattle due to the operation of several factors together such as frothing combined with over-filling and impairment of the ruminal reflexes. No experimental study of colic in the horse has yet been made.

Absorption.

It has been known for many years that certain drugs such as pilocarpine and atropine are absorbed through the rumen epithelium (Trautmann, 1933). However, it was not until 1944 that Barcroft, McAnally and Phillipson found that in sheep at least 1-5 gm. of volatile fatty acid were absorbed every hour by this route, clearly showing that these important products of carbohydrate fermentation entered the body through the rumen. It has since been shown that sodium (Danielli *et al.* 1945), ammonia (McDonald, 1948), sodium orthiodohippurate (Barcroft *et al.*, 1944), hydrocyanic acid (Coop and Blackley, 1949) and inorganic phosphate (Scarisbrick and Ewer, 1951) are absorbed from the rumen. The permeability of the rumen epithelium has been studied in some detail by Parthasaraphy and Phillipson (1953) who found that sodium and potassium were absorbed when the concentration in the rumen liquor exceeded that in the blood. Mercuric chloride did not affect the absorption of these two ions although it inhibited the absorption of chloride and acetate. In a further study of rumen absorption Masson and Phillipson (1951) found that an appreciable quantity of the butyrate leaving the rumen did not enter the blood draining the organ. This has been explained in part by some experiments of Pennington (1952) who found that rumen epithelium *in vitro* could metabolise butyrate, about 50 per cent of which could be accounted for by the ketone bodies formed. Masson and Phillipson (1951) also found that the rate of absorption of acetate was related to the concentration in the arterial blood. These authors noted the appearance of chloride and carbon dioxide in the rumen when aqueous solutions of these lower fatty acids were in that organ.

Support for the idea of the omasum being entirely concerned with the absorption of water has been provided by Garton (1951). He found evidence of the concentration of phosphate, magnesium and calcium in this organ. It is also of interest to note that the amount of volatile fatty acid leaving the abomasum is much less than is absorbed from the rumen (Phillipson *et al.*, 1949), and that less than 6 gm./day of reducing substances enter the ileum (Heald, 1951).

The sole experiment so far discovered on absorption from the equine stomach is that of Colin (1886) who demonstrated that strychnine was not absorbed from this organ. There is evidence for the absorption of glucose from the horse ileum (Alexander, 1954) and for the absorption of fatty acids from the large intestine (Barcroft *et al.* 1944).

The absorption of volatile fatty acids from the ruminant cæcum has been demonstrated (McAnally and Phillipson, 1942) and absorption of water from the cæcum and colon studied (Trautmann and Ascher, 1939). These latter authors found that the quantity absorbed depended on the total amount of sodium

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chloride in solution and not on the concentration. The quantities of sodium sulphate and magnesium sulphate required to cause diarrhoea were much greater than the amount of sodium chloride which produced the same effect. Sporri and Ascher (1940), however, considered the spiral colon to be the main site of water absorption in ruminants although all parts of the large bowel carried out this function.

Secretions.

The most studied secretion of the digestive tract and associated glands of the ruminant has been the saliva. Trautmann and Albrecht (1931) measured the secretion of parotid saliva in goats; the adult goat secreted 0.4-18.5 ml. in 5 min., kids secreted only one-tenth of this. Sharma (1936) found the composition of bovine saliva as follows: S.G. 1.008, pH 8.8, no mucin or ptyalin, water 99.15 per cent, organic matter 0.17 per cent, inorganic 0.68 per cent Na 0.2768, Mg. 0.006 per cent, chlorides 0.0154 per cent, sulphates 0.0145 per cent and phosphates 0.359 per cent A more comprehensive study of the composition of sheep mixed saliva has been made by McDougall (1948) (dry matter 1.0-1.4 gm./100 ml., ash 0.7-0.9 g., Na. 370-462 mg., K 16.46 mg., Ca 1.6-3.0 mg., Mg 0.16-1.0 mg., P 37-72 mg., chloride 23-43 mg., CO_2 117-283 ml pH 8.23). He found the rate of flow varied between 930-1840 ml./day from one gland and was increased by eating and rumination. Reid and Huffman (1949) found bovine saliva had a pH of 8.53 and contained 0.15 mg. ascorbic acid forming about 80 per cent of the rumen ascorbic acid. It had a low surface tension. This latter fact probably accounts for its efficiency as a " wetting " agent.

The rumen, reticulum and omasum are devoid of glandular epithelium, the only secretory part of the ruminant stomach is the abomasum. Sheep (Popov, 1932), goats (Bickel, 1905) and calves (Espe and Cannon, 1937) secrete continuously an acid juice from the abomasal epithelium. This continuous secretion was maintained in the absence of vagal fibres (Popov, 1932). A further difference between ruminants and animals such as dog and man has been provided by Hill (1952). This worker found that insulin decreased the volume and acidity of the abomasal secretion in goats with innervated abomasal pouches. This decrease was unrelated to the degree of hypoglycæmia. In a study of abomasal secretion Kuimov (1952) found a depression after giving copper or sodium sulphate and a stimulation from feeding green oats or fresh hay. Florey *et al.* (1941) found the juice from duodenal fistulæ of sheep and goats thicker than that from the pig, cat or dog and contained much mucin. The sheep juice had a pH of 8.3-8.4; in goats feeding caused a flow of juice and this species secreted as much as 150 ml. in 7 hours. So far as can be ascertained the secretions of the horse's small intestine have not been investigated, however, an interesting observation has been made on the large intestine. Alexander *et al.* (1952) noticed a muco-protein like substance in the liquor of the dorsal colon which, since it was absent from the ventral colon liquor, must have been secreted within the dorsal colon. Histological confirmation of this observation has been provided by Morris (1954) who found goblet cells in much greater numbers in the dorsal

than in the ventral colon. Wright *et al.* (1940) studied the enzymes in duodenal juice from the goat and found no protease, no peptidase, phosphœsterase which hydrolysed ribonucleic acid and adenosine deaminase in the ileal mucosa of the calf.

The larger part of the food of horses and ruminants is reduced to molecules capable of absorption and metabolism through the agency of micro-organisms. So far the enzymes associated with this microbial digestion have attracted little attention. However, Hungate (1943) claims to have shown the presence of a cellulase in Diplodinium, a ciliate inhabiting the rumen of cattle, and enzymes capable of decomposing phenophthalein glucuronide have been found in the rumen micro-organisms (Karunairatnam and Levvy, 1951) and in the micro-organisms of the horse colon (Alexander and Marsh, unpublished). It is possible that such enzymes are concerned in the digestion of polysaccharides containing linked glucuronic acid residues such as hemicellulose (Marsh, Alexander and Levvy, 1952).

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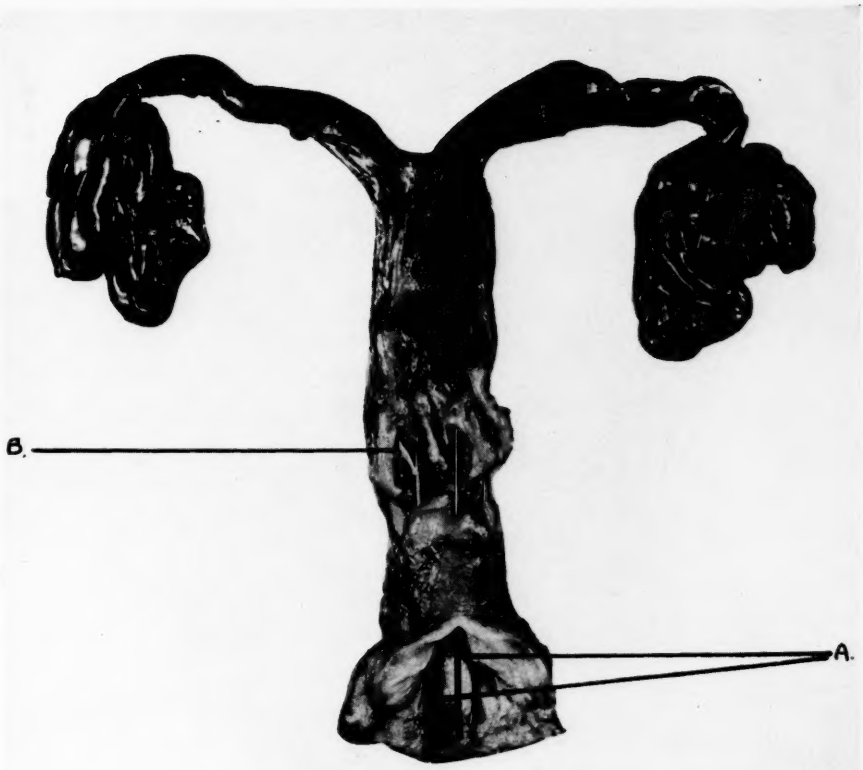

FIG. 1.

DORSAL VIEW.

A. Rods passing through the cervical canals.

B. Fœtal bones within the "body" of the uterus.

(*Article by Morris, page 205*)

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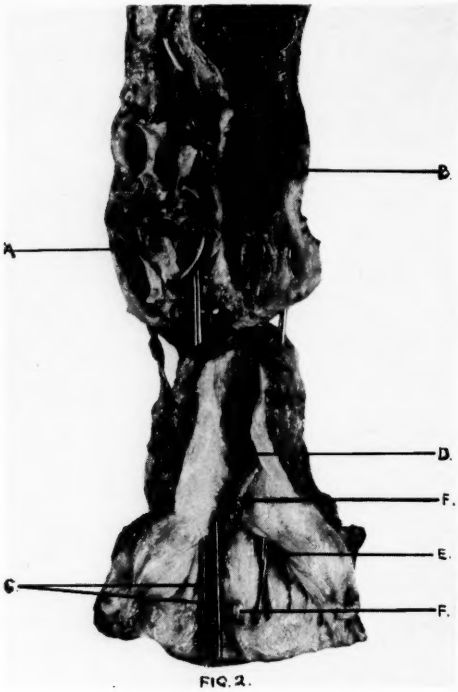

FIG. 2.

Fig. 2

A. Left cavity of the "body" containing fœtal bones.

B. Right cavity of the "body."

C. Rods passing through double opening into the canal communicating with the left cavity.

D. Dorsal canal leading to the right cavity of the "body."

E. Ventral canal leading to the right cavity of the "body."

F. Clitoris-like structures.

Fig. 3

A. Cavities within the "body."

B. Septum between cavities.

C. Left canal opened up to show fibrous strand dividing it caudally.

D. Rod lying in opened up ventral canal leading to the right cavity of the "body."

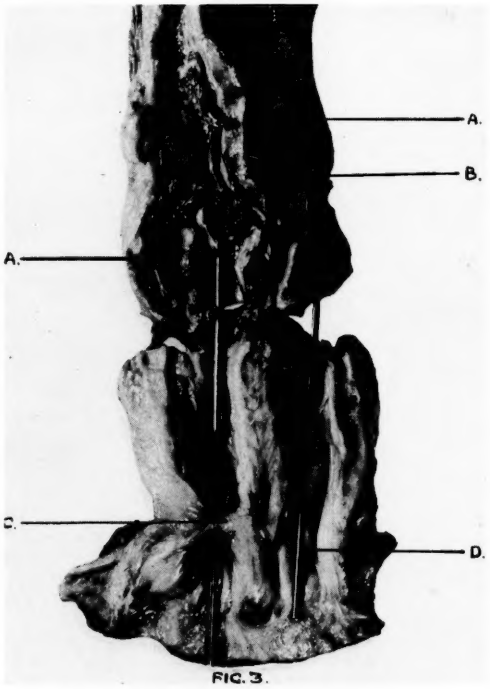

FIG. 3.

(Article by Morris, page 205)

CLINICAL ARTICLE

AN UNUSUAL CASE IN SWINE OF UTERUS DIDELPHYS

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Introduction

IT APPEARS that gross congenital uterine abnormalities are not uncommon causes of sterility in swine (Wilson *et als,* 1949; Warwick *et als,* 1949 and Wiggin, *et als,* 1950). The great majority of cases reported in these studies, however, involved chiefly missing parts of the tract and only three cases of duplication were recorded. Therefore it may be of some interest to record the following unusual case of duplication. The specimen came into our hands while examining a number of sows' uteri for early pregnancy. Fortunately something was known of the previous history of these animals and it is possible to give a case history of the animal from which the specimen was obtained.

Case History

The animal was an outbred gilt and consultation of the records revealed a previous pregnancy, which terminated in labour for close on twelve hours when she finally produced five living piglets and one stillborn. She did not cleanse normally and odd pieces of decomposed tissue and mucous continued to be passed for some time. She ran a temperature, milked poorly and was treated with penicillin and sulphonamides. An attempt at manual cleansing was not very successful and after a day or two some small piglet bones were passed. Three of her piglets died but two were raised successfully.

Anatomical Findings

It was not until an incision had been made into the 'body' of the uterus that any abnormality was detected and in consequence no particular care had been exercised when removing the specimen from the carcase so that when it came into our hands the vulva and the caudal part of the vagina, including the urethral orifice had been cut away and only about three inches of vagina remained. Upon a closer examination of this region two small tag-like structures were seen, medial in position, suggesting clitoris (Fig. II).

The region of the cervix was thickened and the caudal portion tended to project into the vagina, not a normal appearance of the cervix in the sow. In this region was found one of the chief features of interest in this case, the multiloculate nature of the cervix. It was possible to detect three canals passing

through the cervix (Figs. I, II and III). In the specimen the " body " of the uterus possessed two separate cavities (Figs. II and III), two cervical canals passing into the cavity on the right side and one canal into the cavity on the left side. The canal on the left side was subdivided into two portions by a fibrous band (Fig. III). The cavity within the left side of the ' body ' was found to contain the bones of an almost full term fœtus (Fig. II).

Examination of the uterine horns revealed that the left one was abnormally thick-walled for four or five inches from the point where it diverged from the ' body,' and that the wall of the remainder of the horn was of normal thickness with the naked-eye appearance of the mucous membrane also normal. The mucous membrane in the thickened portion showed what appeared to be bands of fibrous tissue. The right horn was normal in appearance and six inches longer than the left.

Unfortunately no careful study could be made of the oviducts and ovaries as they had been removed from the specimen before its abnormality had been detected, but as far as it is known they were normal.

Embryological Features

There can be little doubt that the abnormalities observed in this specimen were of embryonic origin. The Mullerian duct on the right side seems to have developed normally but failed to fuse completely with the left to form a single-cavitied ' body ' of the uterus. The left Mullerian duct formed an abnormal uterine horn with greatly thickened walls and a lining mucous membrane interrupted by what appeared to be fibrous strands. These abnormalities were confined to the caudal six inches or so, where it approached the right horn.

It is difficult to say with certainty how the abnormalities observed in this specimen came into existence. Normally the oviducts, uterus and part of the vagina are developed from the Mullerian ducts. The cranial portions of the ducts form the oviducts and the ' body ' of the uterus, while the cervix and part of the vagina are formed by the fusion of the caudal parts. Therefore, if there were only two canals passing through the cervical region, it would be reasonable to suppose that such an abnormality was the result of incomplete fusion of the Mullerian ducts. In this case however there are at least three canals passing through the cervix and there are two cavities within the ' body.' Therefore the abnormalities must be the result of something more than just the incomplete fusion of the two Mullerian ducts; it is possible that there was a duplication of the Mullerian ducts but if this had been the case, most probably the Wolffian ducts would also have been duplicated as the development of these two structures is so closely associated.

Unfortunately it was not possible to examine the urinary system of this animal, as it might have revealed some further clues. The additional canals found running from the ' body ' of the uterus to the vagina might be remains of the Wolffian ducts, these ducts remaining commonly in the female as vestigal structures in the form of incomplete tubes within the walls of the uterus and

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vagina. Very likely the abnormalities shown by this specimen have been caused by a combination of two features:— (1) the incomplete fusion of the Mullerian ducts and (2) the persistence of the caudal parts of the Wolffian ducts.

Discussion

Defects due to failure of resorption of the median wall of the Mullerian ducts seldom prevent conception but are sometimes responsible for abortion and for parturition difficulties. The frequency of such cases is difficult to estimate because their presence is not always known. Spriggs (1945) has reviewed the most commonly occurring anomaly resulting in cattle, a single median strand of tissue dividing the cervix into two. Of the cases recorded either by him or in his references, an analysis reveals that the majority successfully carried young but in some cases they were difficult to breed.

In humans a most extensive survey is made by Smith (1931). He concludes that incomplete fusion of the Mullerian ducts occurred in about one in every 1,500 obstetrical cases, that the patients showed a less tendency to become pregnant, and that breech presentations, abortions and the necessity for manual removal of the placenta were all more frequent.

Consideration of this case in a sow may indicate that similar difficulties occur in domestic animals.

Acknowledgments

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REVIEWS

Veterinary Pharmacology and Therapeutics, by L. Meyer Jones (1954). Iowa State College Press. Price £4 8s. net.

Experimental pharmacology is one of the younger sciences of medicine, but it is one which, through the rational analysis of drug action and the development of chemotherapeutic agents, has made possible great advances in therapeutics. The use that veterinary medicine is able to make of such advances is to a considerable extent limited by economic considerations, but the veterinary profession has recognised that much is to be gained by the development of veterinary pharmacology, and this confidence finds expression, for example, in the recent publication of the British Veterinary Codex, and in the introduction of experimental pharmacology as a preclinical subject in the new veterinary syllabuses. Professor Jones' book thus appears at an appropriate time. It gives the experimental background to the analysis of the pharmacology of drugs in adequate, but not extensive, detail, and provides a basis for their application and use in therapeutics.

This work is arranged systematically with sections on the actions of drugs divided according to physiological systems, and with further sections dealing with chemotherapeutic agents, antibiotics and parasiticides. The author has not shunned the task of assimilating the most recent advances into his text, incorporating and discussing such topics as the use of hyaluronidase in conjunction with subcutaneous glucose-saline and local anæsthetics, the use of antihistamines in animals, and recently introduced barbituric acid derivatives. Particularly welcome is the chapter on the pharmacology of the rumen, a chapter which will no doubt have to be expanded in future editions to meet the advances being made in this active field of research.

A great deal of experimental work in pharmacology, whilst being performed on animals, has had the development of human medicine as its aim. These same experiments, however, become of direct interest to veterinary medicine, and Professor Jones has abstracted the relevant facts from many such experiments and assembled them so that they may form the basis of a more advanced animal therapeutics. The chapter on coagulants and anti-coagulants illustrates how much useful information may be gathered in this way.

For the student this will prove a valuable text-book, though he might be aided by some expansion of the introductory chapters by the inclusion of more examples of particular drugs which illustrate the general principles discussed. An error in Fig. 7. 1 (page 32) might prove a little puzzling since it renders the figure inconsistant with the description in the text. In the figure, which illustrates a normal distribution curve, the lines representing the limits of standard deviation are misplaced so that they enclose a minority of the individuals

between them instead of a majority. However, these are minor points, in general the book can be wholeheartedly recommended to Veterinary graduates and students.

ADVANCES IN THE CONTROL OF ZOONOSES—Bovine Tuberculosis, Brucellosis, Leptospirosis, Q Fever and Rabies. 1953. Geneva: World Health Organisation. Pp. 276. Price 15s.

THIS monograph contains the principal papers with summaries of the discussions given at the World Health and Food Agriculture Organisations of the United Nations Conference at Vienna in 1952.

"There can be little doubt as to the usefulness of bringing together medical and veterinary workers—whether their work lies in administration, in the laboratory, or in the field—to discuss topics of common interest. Particularly does this apply to zoonoses, where a combined medical and veterinary approach, utilising the full resources of public health and agricultural departments, constitutes the most effective means of combating these diseases . . . To integrate the efforts of public health and agricultural authorities, a development in recent years has been the establishing of veterinary public health units in many countries . . . These units act as a bridge connecting public health and agricultural resources and interests, and serve to synthesise the attack on the various problems of concern to each group . . . The scope of veterinary public health is broader than that of zoonosis control—comprising in addition, for example, food hygiene."

These remarks have been taken from the introduction and they are amply justified when one reads the various sections of this publication. This monograph can be recommended to all who are interested in any of the subjects included; it is not a comprehensive review of our knowledge of these subjects but it contains a wealth of authoritative matter on the advances which have been made recently into these diseases which were selected for their broad interest to the countries of Europe.

The work is attractively produced and include papers by J. N. Ritchie, A. W. Stableforth, H. H. Green, P. Stuart and E. C. Hulse of the Ministry of Agriculture and Fisheries of Great Britain.

A TREASURY OF HORSE STORIES. Edited by Margaret Cabel Self. Illustrations by Michael Lyne. London: Hutchinson. Price 21s. net.

THE word "anthology" is derived from the words *anthos* and *legein* which mean "flower" and "gather." Literally it indicates a collection of flowers but by common usage it has come to mean a collection of beautiful passages from literature and especially of poetry.

Flowers are an expression of the beauty of the gardens and fields, beautiful words epitomise the gracious concord of speech, but to many of us the form and charm of a horse surpasses them all. In this book, so rightly called, Margaret

Cabel Self has gathered together a veritable "Golden Bough" of stories and poems. From the purely literary point of view the pages are filled with matter of great merit, the fact that they are orientated around the horse is an added attraction.

There are tales founded on fantasy, folklore and sport; and history, drama and humour run through the pages. Each item is a literary gem and by an author of renown.

This book will delight all those who have an eye for a horse and Michael Lyne's illustrations will add to their pleasure.

CANINE MEDICINE, by 40 Authors. Edited by H. Preston Hoskins, J. V. Lacroix and Karl Mayer. Pages xix + 631. Evanston, Illinois: American Veterinary Publications. Price £5.

THIS book consists of a number of contributions covering a wide field of canine medicine. Since it is the work of no less than forty authors, engaged in general practice, teaching and research, it is to be expected that the different contributions would vary in scope, detail and the method of presentation. Having been prepared by acknowledged authorities, this work can be recommended as a work of reference to those engaged in canine practice but the reviewer thinks that it is too advanced for students. The book needs to be read with a background of experience, if full advantage is to be derived from its pages.

We would recommend the chapter on "Clinical Examination" to students and young graduates for the sound advice given on the relationship between practitioner and client. A deal of space has been expended unnecessarily in this and the following chapter on simple clinical techniques which every British student should have mastered even before he enters upon his final year of study.

The general production and printing is good but for a book of this price one is entitled to expect a better binding. The work is profusely illustrated, most of the illustrations serve a very useful purpose but many give no indication as to their relative sizes of reproduction and thus much of their usefulness is lost. The X-ray reproductions bear no reference to the use of opaque substances (which have obviously been employed) and, in some instances, their standard is poor.

Long lists of references are given—some we feel are too copious and too much confined to American literature, whilst in others lack of adequate references is a disadvantage.

An interesting innovation are the chapters on Gerontology and Geriatrics.

The chapter devoted to Inhalation Therapy is interesting and contains much which will prove of use to those who wish to utilise on this type of treatment.

We were disappointed in the ten-page chapter on Euthanasia. It is not restricted to the dog, for canaries and cats also find a place in its pages. We note with some surprise strychnine is included as an agent for euthanasia, and that the main disadvantage to the use of strychnine and potassium cyanide appears to be the risk to the operator. The author states: "There is probably no other means of taking life which acts with the speed of electrocution. There

is ample evidence, scientific and otherwise, to definitely prove that electrocution of animals produces unconsciousness and death without conscious pain of any sort." We suggest that the directions—and illustrations—given may not bring about euthanasia as envisaged by the author, and would direct his attention to the work of Dr. Phyllis Croft and others, in this country.

Despite these criticisms we feel that all small animal clinicians will find a wealth of information in the pages of this book.

THE PRINCIPLES AND PRACTICE OF FEEDING FARM ANIMALS, by E. T. Halnan and Frank H. Garner. London: Longmans, Green and Co., Ltd. Price 25s. net.

THIS textbook, now in its fourth edition, can be recommended to those who are responsible for the feeding of farm animals in Great Britain, and to students of animal nutrition for it is written in simple straightforward language which the beginner can comprehend easily.

The subject matter is divided into two sections. The first is concerned with theoretical considerations. Included in this section are some simple yet useful diagrams showing the anatomical differences in the digestive systems of the various farm animals.

The second section deals with the more practical considerations. The authors point out that different systems of management call for different feeding-stuffs in the rations. Examples of rations are given for the various species of animals. The authors stress that one must not be dogmatic, but one should be prepared to use initiative and common sense in compiling rations.

In the chapter on grassland the authors stress that to obtain the best use of grass, skilful management both of the sward and of the grazing animal is necessary. The botanical composition of the sward and manuring is discussed.

Methods of preserving grass as hay, silage and dried grass are described.

The chapter on the preparation of feeding stuffs is a useful one because it makes available and in short compass, valuable information gleaned from many sources.

One very obvious error occurs on page 290, " it is necessary to feed young pigs three times a week," this surely should be three times a day.

NEWS

FOWL TYPHOID

THERE is news for poultry keepers in a preliminary report on the effect of a new means of treating fowl typhoid just issued by the Poultry Research Station of the Animal Health Trust.

It arises from an experiment by Dr. H. Williams Smith, M.Sc., MR.C.V.S., Dip.Bact., a member of the Trust's staff, in the use of a drug known as Furazolidone in the treatment of this disease.

Of 120 nine-weeks-old chickens infected, 90 were treated and 30 left untreated. Of the treated chicks only two died, while 21 of the untreated succumbed. Of the 88 treated chickens which recovered only one remained a carrier, while all the surviving untreated chickens were found on test to be carriers. "This is an extremely important point," says the Trust, who observe that in recent years fowl typhoid has become one of the most serious causes of mortality in certain areas of the country, particularly in the north-east of Yorkshire, the north-western midlands and Wales.

BURROUGHS WELLCOME & Co. announce the introduction of "Wellcome" brand Myxomatosis Vaccine for the immunisation of domestic rabbits. The vaccine which is prepared in the Wellcome Research Laboratories is a tissue suspension containing the virus of Shope fibroma. The manufacturers state a dose of 0.5 c.c. injected subcutaneously provides a useful level of protection, lasting at least six months, in the great majority of rabbits.

"Wellcome" Myxomatosis Vaccine is issued in bottles of 5 c.c. (10 doses). Since this living virus vaccine may not remain potent for more than fourteen days from the date of preparation, members of the profession should order material to meet known requirements only.

This vaccine is one of the weapons which will be used to prevent the decimation of the domestic rabbit population by myxomatosis now established in this country and expected to spread during the coming months.

GLAXO LABORATORIES LTD. announce the introduction from April 5 of Streptovex, a new Streptomycin preparation containing 8 gms. streptomycin sulphate in 8 fluid oz. of solution.

This product provides an economical and simple dispensing preparation of oral streptomycin for use in the treatment and prophylaxis of scouring conditions in calves, pigs and dogs.

Details of dosing can be obtained from the manufacturers who state that whereas oral penicillin gives a good measure of protection from unspecified scours plus a growth promoting effect, streptomycin is necessary and specific for the treatment of infectious scours. It can also be used for prophylaxis on farms where a high incidence of scouring is experienced.

ERRATUM

In the article by Ford, Wilmshurst and Karib on page 96 of March issue the formula of the drug Ethidium Bromide is incorrectly stated. This should read: 2:7 diamino-10-ethyl-9-phenyl phenanthridinium bromide.

Publishers' Notices

THE BRITISH VETERINARY JOURNAL, with which is incorporated THE VETERINARY JOURNAL, is published monthly, and copy for advertisements should be in the hands of the advertisement manager not later than the 20th of the preceding month, if proof is required. Tel.: Temple Bar 3386.

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

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